ATLAS Delivery Document

Checkout and Launch Control System (CLCS)

84K00150-003

NOTE: See "**Supporting Document Note**" on following page

Approval Working Baseline:

Retha Hart, NASA, Project Manager, CLCS	Date	George R. Hurt, NASA, Deputy Project Manager, CLCS	Date
Jeffrey D. Wheeler, NASA, User Liaison CLCS	Date	Chris Best, USA, User Liaison CLCS	Date
Kirk Lougheed, Chief System Engineering & Integration CLCS	Date		

PLEASE NOTE:
****** SIGNATURES CONSTITUTE APPROVAL TO PROMOTE DRAFT .7 TO BASIC, TO BE USED, FOR DP-1 ASSESSMENT WORK ONLY ******

Design Panel 1 Assessment Signoff

Description	Date	Thread Lead	System Engineering & Integration
Expert System IPT	___/___/___	Frank Norris	
Hypergolic Maintenance Facility IPT	3/16/98	Rich Ikerd	
Vehicle Power-Up/Power-Down IPT	3/16/98	Rich Ikerd	
Launch Operations IPT	3/16/98	Rich Ikerd	
Orbiter/SRB Hydraulics IPT	3/16/98	Rich Ikerd	
Cryogenics, Main Propulsion and FIREX Water IPT	3/16/98	Rich Ikerd	
System Capability Demonstration 2 Test Case	3/16/98	Mike Perry	
System Test Case	___/___/___	Ren Frank, Ken Clark	
PCM Support Completion Thread	2/2/98	Chau Le	
Launch Data Bus Interface Phase 2 Thread	2/13/98	Van Bullington.	
Hardware Safing System Phase 1 Thread	2/13/98	Rick Dawson	
System Timing Thread	2/13/98	Alex Morales	
IVHM, Record Playback Subsystem, Hazardous Gas, and other Consolidated Data Thread	2/2/98	Emilio Valencia	

Design Panel 1 Assessment Signoff

Description	Date	Thread Lead	System Engineering & Integration
Commanding and Command Processor Phase 3 Thread	2/2/98	Jack Blackledge	
System Data and Routing Thread	2/13/98	Brian Bateman	
Command and Control Workstation Phase 1 Thread	2/13/98	Deborah Lee	
Redundancy Management Phase 1 Thread	2/13/98	Jack Blackledge	
System Control Phase 1 Thread	2/13/98	Brian Bateman	
Check Point Restart	2/13/98	Darrell Bushard	
Business And Support Information Services (BASIS) Phase 1	2/2/98	Rex Stanley	
Desktop Debug Environment Phase 2 Thread	2/2/98	Al Folensbee	
Near Real-time Advisory Thread	2/2/98	Tom Beever	
Advanced Retrieval Thread	2/2/98	Tom Beever	
End Item Manager, Phase 2 Thread	___/___/___	John Copella	
Constraint Manager Completion Thread	2/13/98	Davis Rodney	
Log Record and Retrieval Phase 2 Thread	2/13/98	Rex Stanley	
System Build, Platform and Load Phase 2 Thread	2/2/98	Al Menendez	
Test Build and Load, Phase 2 Thread	2/2/98	Charla King	

Design Panel 1 Assessment Signoff

Description	Date	Thread Lead	System Engineering & Integration
Shuttle Data Center - Record Retrieval - CDS Re-platform	___/___/___	Tony Perry	
Simulation Re-host	___/___/___	Scott Estes	

Strategic Engineering System Integration and Test
CLCS Project

PREPARED BY:

Jeffrey D. Lee USA

Supporting Document Note: Acronyms and definitions of many common CLCS terms may be found in the following documents: CLCS Acronyms 84K00240 and CLCS Project Glossary 84K00250.

REVISION HISTORY

REV	DESCRIPTION	DATE
Draft 0.0	Not Ready Yet	12/5/97
Draft 0.1	Update DDE, Timing Test Progress Monitoring and Basis	12/10/97
Draft 0.2	Update from Mark and Jack	1/5/98
Draft 0.3	Table Top and inputs from Ben and Greg	1/9/98
Draft 0.4	Table Top 2 and inputs from Tom and JW	1/14/98
Draft 0.5	Final Inputs	1/16/98
Draft 0.6	Copy to Thread Leads	1/19/98
Draft 0.7	Format with CLCS Template	1/29/98
Basic	Promoted per approval per PM & SEI Chief to be used for DP-1 assessments only, according to KDP-P-1173	5/8/98

LIST OF EFFECTIVE PAGES				
Dates of issue of change pages are:				
Page No.	**A or D***	**Issue or Change No.**	**CR No.**	**Effective Date****
ALL				

Open Items

Editor Note To be replaced with drawing of IDE Dennis Fougnie

Editor Note: To be replaced by software drawing from Robert Pierce.

Editor Note: Need input for Facilities Steve Gersten & Tom Brauer.

Editor note need equipment list for SDC Serial 0 Tony Perry

Editor note need equipment list for SDC Production Set 1 Tony Perry

Editor note need equipment list for Simulation Production Set 1 Scott Estes

Editor Note need input for prototype Test tools Dennis Fougnie

Editor Note need input for prototype Timing Equipment Dennis Fougnie

Editor Note need more detail on SE&I Documents

Editor Note Need Statement of Work System Build JW

Editor Note Need Statement of Work Test Build JW

Editor Note Need to fill in and all allocation tables updated DP1

Table of Contents

1.

1. DELIV

The Atlas Delivery is scheduled for completion on September, 25 1998. It is the fourth delivery of the CLCS Project. Atlas consists of hardware, software, and facility products that will support the continuing CLCS development. Significant products deliveries will provide the foundation for the CLCS hardware and software architecture.

1.1 TOP LEVEL OVERVIEW

The Atlas delivery focuses on providing support of End Item Command and Control. This delivery will support full application development and set the ground work for the development of important system reliability and integrity features in the Atlas Delivery.

1.1.1 Deliverable Types

The work in Atlas is divided into nine sets of deliverable types.

- **Facilities -** The modification work to be performed at a facility.
- **CLCS Sets -** Describes sets of equipment and their content at the end of this delivery
- **Hardware Products -** The hardware products that we will design and/or deliver during this delivery. They use the hardware development process and require reviews, approvals and buy-off.
- **System Engineering Action -** The work required to support the Titan delivery in the major design areas. This is not all the work that is being performed in the System Design function of System Engineering & Integration just the major elements to support the next delivery.
- **Integrated Product Teams -** These are the application set development products. They use the application development process and require reviews, approvals and buy-off.
- **Pathfinders -** These are tasks to support activities in the next delivery. They are designed to find answers to design items in a less structured format. They are required to present a concept panel and status reports. They are under review regularly for redirection, termination or conversion to thread work.
- **System Test Cases -** These are procedure and software to demonstrate and measure system level performance. They use a modified delivery and require reviews, approvals and buy-off.
- **Threads -** Threads are used to drive the development of system functions. They use the system software and hardware development process and require reviews, approvals and buy-off.
- **Delivery Action -** Delivery actions are used to track the progress of turn over of CLCS products to the operational world

1.1.2

Delivery Activities

Required Activities	System Engineering Action	Facilities	Sets	Hardware Product COTS	IPTs	Pathfinders	System Test Case	Threads	Delivery Actions
Presentation									**X**
Design Panel 1 Concept					**X**	**X**	**X**	**X**	
Design Panel 2 Requirement (CSCI)								**X**	
Design Panel 2 Requirement (HWCI)				**X**				**X**	
Design Panel 2 Requirement (Test Case)				**X**			**X**		
IPT Requirement Review					**X**				
Design Panel 3 Design (CSCI)								**X**	
Design Panel 3 Design (HWCI)				**X**				**X**	
Design Panel 3 Design (Test Case)				**X**			**X**		
IPT Design Review					**X**				
Status Reports						**X**			**X**
Schedule	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Delivery	**X**	**X**	**X**	**X**		**?**			**X**
Test Plan (CSCI)/(HWCI)				**X**			**X**	**X**	
System Test Plan								**X**	
Design Panel System Test Plan							**X**		
CIT (CSCI)								**X**	
HIT (HWCI)				**X**					
System Test							**X**	**X**	
User Testing					**X**				
Demonstration					**X**	**?**			
Final Report						**X**	**X**		
Procurement Strategy				**X**					
Product Specification Review				**X**					

1.1.3

Approval Process

Atlas Working Baseline Review (Draft .x) Copy 12/5/97

Project Management, Users, System Engineering

Scope Approval

System Engineering, CSCI/CSC,

Users, work toward DP1s

Atlas Working Baseline (Baseline 1.x) 1/9/98

Design Panel 1 Concept

Update to details of SOW but not scope

Thread Leads and System Engineering & Integration Signoff of DP1 Updates

Atlas Baseline 3/6/98

Project Management, Users, System Engineering Review

Atlas Approval Baseline 3/13/98

Performing Organizations Sign Off

Atlas CCB Baseline 3/20/98

1.1.4

Major Events

The major events to occur during the Atlas Delivery are:

1. Perform system portability test.
2. Release the Atlas System Design Document
3. Install Hardware in OCR 1
4. Get Ready for user acceptance at the Hypergolic Maintenance Facility
5. Start initial operation Shuttle Data Center
6. Start initial operation of the re-hosted simulation system

1.1.5 System Capabilities

The significant capabilities provided by CLCS in this delivery are:

1. The capability to demonstrate Hypergolic Maintenance Facility Forward Reaction Control System and Aft Propulsion System applications.
2. The full capability to interface with the Ground Data Bus.
3. The full capability to interface with the Orbiter Downlink including Space Shuttle Main Engine.
4. The capability to perform predominate of the interface functions with the Launch Data Bus.
5. The capability to perform initial failover and checkpoint functions.
6. The capability to perform full application development.
7. The capability to receive consolidated data from METRO, GMS, IVHM, Fuel Cell Monitor, Record Playback System and Hazardous Gas systems.
8. The initial Test Application Script capabilities.
9. Initial safing system
10. Prototype Programmable Function Panel
11. Provide initial BASIS

1.1.6

Deliveries Summary

- 8 CLCS Sets
- 2 Shuttle Data Center Sets
- 1 Simulation Set
- 17 Hardware Products
- 6 System Engineering Actions.
- 1 Pathfinders
- 5 Integrated Product Teams
- 2 System Test Cases
- 6 Gateway Threads
- 6 Foundation Threads
- 3 Application Software Threads
- 2 Application Support Threads
- 3 System Support Threads
- 2 Delivery and Activation Threads
- Associated CSCI Products, HWCI products, facility products and the support products discussed further in this document.

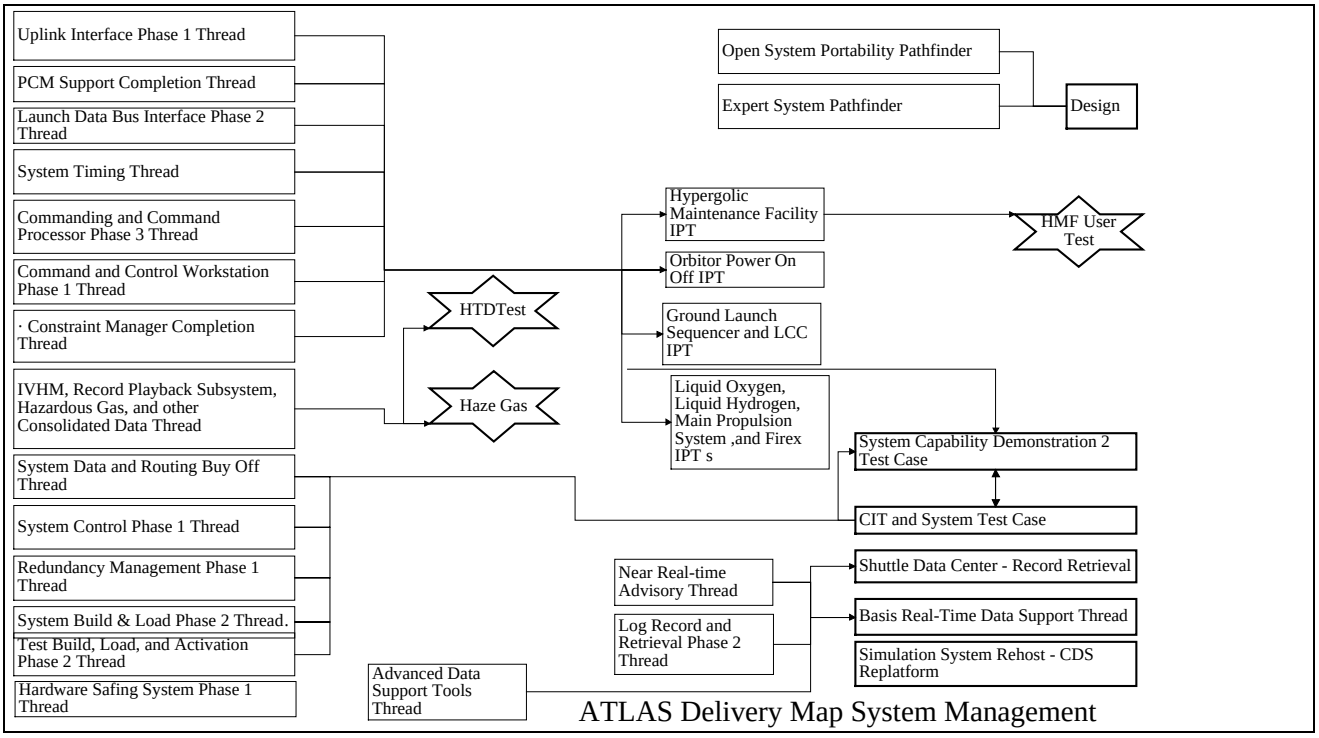

Figure 1 provides a high level map of the interrelationship of the various delivery elements that make up this delivery. The details of this map are in the Atlas Delivery Map.

1.1.7

System Diagram

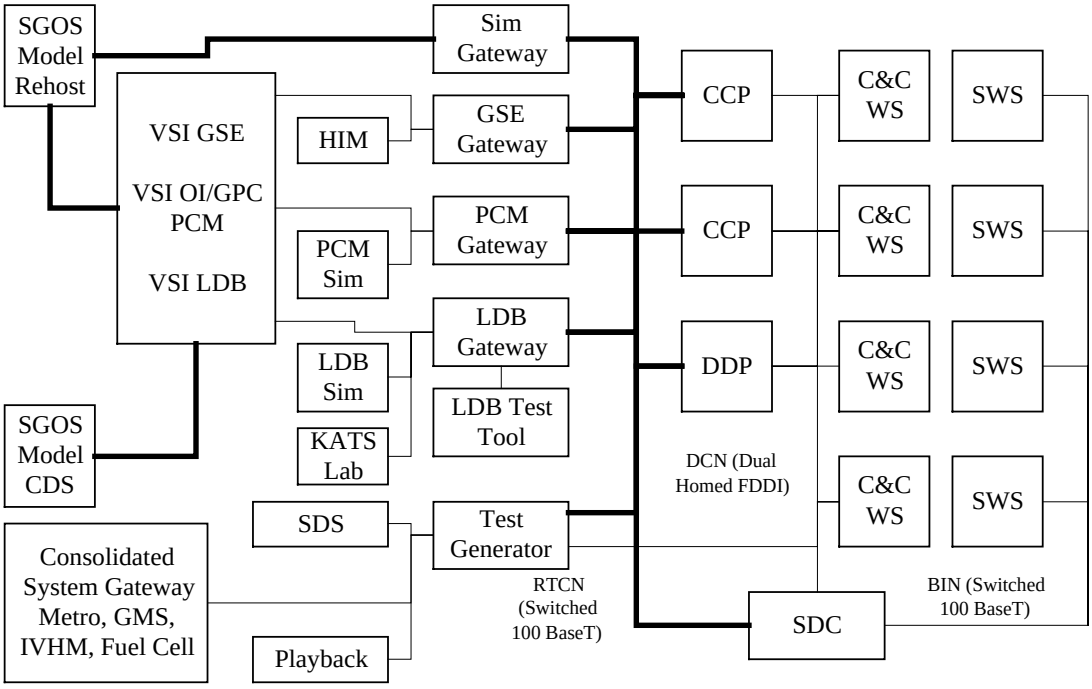

Figure 2 provides a high level hardware block diagram of the Atlas system. The details of this block diagram are in the ATLAS set drawings for the Integrated Development Environment, Satellite Development Environment-1, Satellite Development Environment-2 and Hypergolic Maintenance Facility.

Editor Note To be replaced with drawing of IDE Dennis Fougnie

1.1.8 Software Diagram

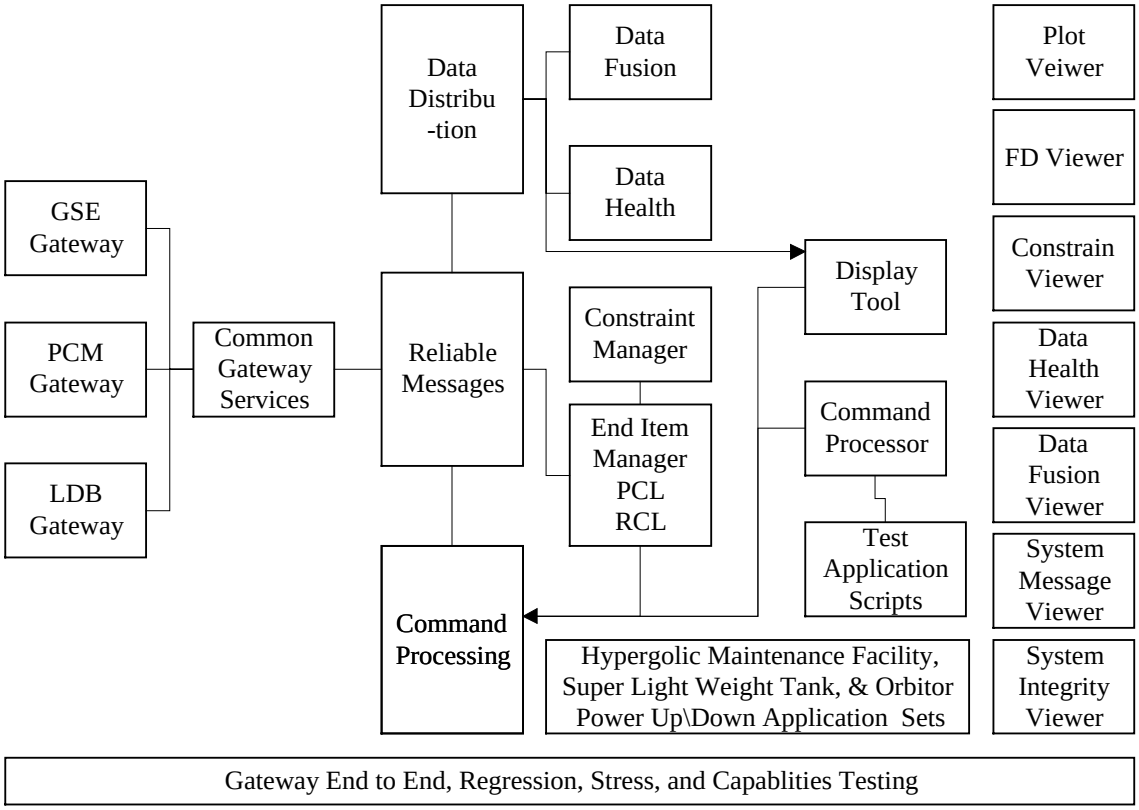

Figure 3 provides a high level diagram of the RTPS software for the Atlas delivery

Editor Note: To be replaced by software drawing from Robert Pierce.

1.1.9

Requirements

The thread contain references to System Level Specification and Other System Requirements. The inclusion of the SLS requirements and Other System Requirements are to document those requirements that apply to this thread. As part of Design Panel 1 and Design Panel 2 a more complete list of products requirements affecting the thread are developed.

The other system requirement can in most case be traced back to requirement for Real time Control Application Service APIs matrix. They have been re-written to reflect system capabilities. Only those requirement label for Atlas or earlier are included.

As part of that process the developers are ask to analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

To aid in this process the requirement have been labeled as follows:

- [Review] Requirement may be in question or needs rewrite. 22 Atlas
- [Reference] Requirement is for reference , end state design . 44 Atlas
- [Partial] Requirement will be partially completed. This requirement may or may not be testable at the system requirement level. 97 Atlas
- [Complete] Requirement is complete within current stage of the project. Additional capability will be added in future deliveries. This requirement will be testable at the system requirement level. 267 Atlas
- [Done] This requirement is complete for the project and all aspect can be tested. 3 Atlas
- [Validate] This requirement and the environment that it is running at are at a level to allow this requirement to be validated. Note none for Atlas However post Atlas a validation will be required for HMF.

1.2

DELIVERABLE DETAILS

Facilities

- LCC
  - First Floor
  - Integrated Development Environment
  - Shuttle data Center
  - Launch Control Center X
  - Operational Control Room 1
- PCC
- Complex C
- HMF
- SAIL

Sets

- Operational Control Room 1-LCC
- Operational Control Room-Hypergolic Maintenance Facility
- Operational Control Room-SAIL Facility
- Integrated Development Envirnoment-1-LCC
- Satellite Development Environment--JSC
- Satellite Development Envirnoment-1-PCC
- Satellite Development Envirnoment-2-PCC
- Launch Control Center X
- Serial 0 Shuttle Data Center
- Shuttle Data Center Production Set 1
- Simulation Production Set

Hardware Products

- Production Console Enclosures
- Production Command and Control Workstation
- BASIS Support Workstation
- Production Data Distribution Processor
- Production Command and Control Processor
- Power Distribution Chassis
- Command Panel
- Production Equipment Racks
- Production Gateway
- Real-Time Critical Network

- Display and Command Network Components
- BIN Components
- Assorted CLCS Servers
- CLCS Test Tools
- Prototype Data Recording Port
- Prototype Emergency Safing System Components
- Prototype Timing System Components

System Engineering Action

- Release the Atlas System Design Document
- Provide System wide Data Flow Diagrams
- Provide System Wide Timing Allocation for end-to-end performance requirements.
- Develop structure and templates for Subsystem Engineering Package for both hardware and software.
- Performance Modeling
- Open System Porting

Pathfinders

- **Expert Systems Pathfinder -** This pathfinder will explore advisory and expert systems capabilities. An advisory system is one that analyses system problems and advises the operator. An expert system is one that analyses system problems and then takes action.

Integrated Product Teams

- **Hypergolic Maintenance Facility IPT** - This IPT will design and implement the Hypergolic Maintenance Facility Application Software. It is a CLCS delivery into an operational environment.
- **Vehicle Power Up / Down IPT -** This IPT will develop an Application software suite to support the automated power up/down of the Space Shuttle. The suite includes the auto power up/down sequence which is required by the Test Project Engineer (TPE), and the supporting subsystem software for the: Data Processing System (DPS), Environmental Control and Life Support System (ECLSS), Electrical Power and Distribution System (EPDC), Instrumentation System (INST), and Integrated Operations (INT).
- **Launch Operations IPT -** This IPT will develop an Application software suite to support the automation of the Ground Launch Sequence.
- **Orbiter and Solid Rocket Motors Hydraulics IPT -.** This IPT will develop an Application Software Suit to support the automation of Ground Support Equipment functions for Hydraulic on the Solid Rocket Motors and the Orbiter.
- **Cryogenic, Main Propulsion System ,and FIREX IPT** - This IPT will develop an Application software suite to support the automation of Ground Support Equipment functions for Liquid Oxygen, Liquid Hydrogen, Main Propulsion System, and FIREX systems

System Test Cases

- **System Capability Demonstration Phase 2 Test Case -** This test case will build on the Thor demonstration of System Capability. It will demonstrate capabilities to run application software
- **System Test Phase 1 Test Case -** This action develops the system test framework for CLCS including Stress, Regression., Performance, and Functional test.

Threads

- **Uplink Interface Phase 1 Thread -** The Uplink Interface Phase 1 Thread establishes the initial capability to command via the PCM uplink. Recording, Retrieval, Databank, application services, display services, Command, System Build services and Test Build services will support basic Uplink capability.
- **PCM Down Link Support Completion Thread -** This thread provides a fully functional PCM Gateway. This is needed to allow development of the Power Up/Down in the Titan delivery.
- **Launch Data Bus Interface Phase 2 Thread -** This thread builds on the initial capability to monitor and command the Launch Data Bus.
- **Hardware Safing System Phase 1 Thread -** This thread provides the initial hardware safing system design and prototype units.
- **System Timing Thread -** This thread provides synchronization with Coordinated Universal Time, the generation of Countdown Time, and Mission Elapsed Time, and supports of the Time Management Distribution System.
- **IVHM, Record Playback Subsystem, Hazardous Gas, and other Consolidated Data Thread -** This thread provides process improvement to the current operations by providing increased visibility into the Integrated Vehicle Health Monitoring System, the Record Playback System, and Hazardous Gas System. These measurements will be consolidated into the Consolidated System Gateway and be provided to the Shuttle Data Stream. This will make this data available in the current operational area and allow it to be used in the future by the CLCS system.
- **Commanding and Command Processor Phase 3 Thread** - This thread supports commanding by cursor control, manual input, Test Application Scripts and End Item Managers. This thread will also provide Validation Test Cases for System Level Specification and Application Requirements.
- **System Data and Routing Thread -** This thread completes the efforts to provide data to the RTPS, provide for system logical routing and development of Validation Test Cases for System Level Specification and Application Requirements.
- **Command and Control Workstation Phase 1 Thread -** This thread provides the integration of and upgrades to the Command and Control Workstation to support the total user environment. It includes work on viewers, Dynamic Display Tools, User Environment Management, and Operation.
- **System Control Phase 1 Thread -** This thread provide the infrastructure needed to manage, control, assign, allocate, and monitor the RTPS.
- **Redundancy Management Phase 1 Thread -** This thread provides the base for constructing a fault tolerant RTPS. It provides for the detection of subsystem failures, monitoring of active counterparts, and the execution of fail-safe or failover functions..
- **Subsystem Check Point Restart -** This thread provides the capability to save the state of various tables to reflect their updated state as a result of real-time table updates. It also provides the capability to restore the system to a previously saved state.

- **Business And Support Information Services (BASIS) Phase 1.-** This thread take the effort of the BASIS pathfinder and other activities to provide an early deployment of the Support Workstation in the LCC.
- **Desktop Debug Environment Phase 2 Thread -** This thread establishes the application software Desktop Debug Environment (DDE) by building on the Thor Test Bed Pathfinder products
- **Near Real-time Advisory Thread -** This thread provides advisory system capabilities for the CLCS Support Workstation and the Office Environment
- **Data Support Tools Thread -** This thread provides historical data retrieval and analysis similar to but improved upon what is found on the CDS HI-TRAX system today.
- **Constraint Manager Completion Thread -** This thread builds on the initial Constraint Management Tool. Constraint Management provides the capability to monitor Measurement FDs for a predetermined condition and notify personnel operating the Test Set and software applications executing within the Test Set that the monitored data no longer meets the predetermined condition.
- **Log Record and Retrieval Phase 2 Thread -** This thread establishes the frame work for CLCS data recording/retrieval, and begins the migration of the retrieval process from the CCMS PDR/SPA and CDS/Shuttle Data Center to the CLCS system.
- **System Build, Platform Build and Load Phase 2 Thread -** This thread supports the definition, build, and loading of target CLCS Sets that are independent of Test Build.
- **Test Build and Load Phase 2 Thread -** This thread supports test definition, build, load and activation of a Target CLCS Set that has been loaded with a System Build load

Operational Deliveries

- **Shuttle Data Center - Record Retrieval - CDS Re-platform -** This delivery provides continued use of the Shuttle Data Center as a replacement for CDS.
- **Simulation System Re-host - CDS Re-platform -** This delivery provides initial use of the re-hosted simulation system.

2.

FACILITIES -- CONTROL ROOMS AND DEVELOPMENT ENVIRONMENTS

Editor Note: Need input for Facilities Steve Gersten & Tom Brauer.

2.1 LCC

2.1.1 LCC First Floor

- No activities planned for LCC First Floor for the ATLAS Delivery

2.1.2 IDE-1 Second Floor

- LCC Room 2R23/24 Prepped for integrated system level testing Including:
  - Communications Consumables
  - Gateway Data Links
  - Simulation Data Links
  - Connectivity to LCC-X Command and Control Workstation

2.1.3 Shuttle Data Center Third Floor

2.1.4 LCC-X Third Floor

2.1.5 Operational Control Room 1

- Decommission LCC4
- Complete OCR -1 Facility Modifications
- Install and activate initial subset of OCR-1 hardware (to be used as IDE-2)

2.2

PCC (SATELLITE DEVELOPMENT ENVIRONMENTS 1 AND 2)

2.3 COMPLEX C (SATELLITE DEVELOPMENT ENVIRONMENT-C)

2.4 HMF

2.5 SAIL

- Install Production Console Enclosures
- Install and activate set hardware at SAIL
- M7-1061 Option 1 Facility Prepared For Development Activity during Atlas Delivery Time frame

3.

CLCS SETS

This is a list of the hardware in the facilities for CLCS. Note this is the state for all hardware at the end of this delivery after purchase of new equipment, use of existing equipment and moving of equipment from one set to another..

3.1 OPERATIONAL CONTROL ROOM 1—LCC

Overview:

Perform an installation of a subset of OCR-1 hardware that will be initially used as an additional Integrated Development Environment (IDE-2) at the LCC for System Software and Application Software Development

HWCIs

Quantity	Part Number	Product Type
12	84K04505	System Engineering Console (stuffed)
3	84K04510	Test Conductor Console (stuffed)
10	84K04515	Console Support Module (stuffed)
10	84K04525	Peripheral Housing (stuffed)
2	84K048XX	Real-Time Critical Network Rack Assembly
2	84K048XX	Display and Command Network Rack Assembly
1	84K047XX	Data Distribution Processor Assembly
1	84K047XX	Command and Control Processor Assembly
1	84K047XX	Data Distribution Processor/Command and Control Processor Spare
1	TBD	Prototype Data Recording Port Assembly
1	Sun Ultrasparc W/S	Gateway Development W/S
1	TBP	Network Time Server
1	TBP	Network Server
1	TBP	Network Management Workstation
1	TBP	RON Network Server
1	84K02502-XXX	CM/Boot Server
1	TBP	Local OMI Server
1	TBP	RTPS Firewall
2	84K0XXXX	BIN Rack Assembly
2	84K04902-0XX	CLCS Ground Support Equipment Gateway
2	84K04902-0XX	CLCS Consolidated Systems Gateway
1	TBD	Simulation Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.2

OPERATIONAL CONTROL ROOM- HYPERGOLIC MAINTENANCE FACILITY

Product Overview:

Provide a Satellite Development Environment at the Hypergolic Maintenance Facility for System Software and Application Software Development

- Replace all "Console Tables" with Production Console Enclosures
- Retrofit all Command and Control Workstation and BASIS Support Workstations with Production Hardware
- Retrofit all Gateway Chassis and Single Board Computers with Production Hardware
- Augment HMF Set by installing "Hardware Drop 2"
- Retrofit all equipment racks with Production Hardware
- Retrofit Power Distribution Panels with Production Power Distribution Chassis

HWCIs

Quantity	Part Number	Product Type
ug 5	84K04505	System Engineering Console (stuffed)
ug 4	84K04515	Console Support Module (stuffed)
ug 4	84K04525	Peripheral Housing (stuffed)
* 1	84K048XX	Real-Time Critical Network Rack Assembly
* 2	84K048XX	Display and Command Network Rack Assembly
ug 1	84K047XX	Data Distribution Processor Assembly
ug 1	84K047XX	Command and Control Processor Assembly
ug 1	84K047XX	Data Distribution Processor/Command and Control Processor Spare
1	TBD	Prototype Data Recording Port Assembly
* 1	Sun Ultrasparc W/S	Gateway Development W/S
* 1	TBP	Network Time Server
* 1	TBP	Network Server
* 1	TBP	Network Management Workstation
* 1	TBP	RON Network Server
* 1	84K02502-XXX	CM/Boot Server
* 1	TBP	Local OMI Server
* 1	TBP	RTPS Firewall
* 2	84K0XXXX	BIN Rack Assembly
ug 4	84K04902-0XX	CLCS Ground Support Equipment Gateway
1	TBD	Simulation Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.3

OPERATIONAL CONTROL ROOM- SAIL FACILITY

Product Overview:

Provide a Satellite Development Environment at the SAIL Facility for System Software and Application Software Development

HWCIs

Quantity	Part Number	Product Type
6	84K04505	System Engineering Console (stuffed)
2	84K04515	Console Support Module (stuffed)
2	84K04525	Peripheral Housing (stuffed)
1	84K048XX	Real-Time Critical Network Rack Assembly
1	84K048XX	Display and Command Network Rack Assembly
1	84K047XX	Data Distribution Processor Assembly
1	84K047XX	Command and Control Processor Assembly
1	84K047XX	Data Distribution Processor/Command and Control Processor Spare
1	Sun Ultrasparc W/S	Gateway Development W/S
1	TBP	Network Time Server
1	TBP	Network Server
1	TBP	Network Management Workstation
1	TBP	RON Network Server
1	84K02502-XXX	CM/Boot Server
1	TBP	Local OMI Server
1	TBP	RTPS Firewall
2	84K0XXXX	BIN Rack Assembly
* 2	TBD	CLCS PCM D/L Gateway
* 1	TBD	CLCS LDB Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.4

INTEGRATED DEVELOPMENT ENVIRNOMENT-1-LCC

Product Overview:

Augment the existing Development Environment for System Software and Application Software Integrated Testing and Operational Deployment Preparation

- Replace all Prototype/First Article Console Enclosures with Production Enclosures
- Retrofit all Command and Control Workstation and BASIS Support Workstations with Production Hardware
- Retrofit all CCMS Safing Panels with Prototype CLCS Emergency Safing System Panels
- Retrofit all Data Distribution Processor, Command and Control Processor and Gateway hardware allocated to LCC-X with production hardware
- Retrofit all equipment racks with Production Hardware, without impacting CLCS Integration, Testing and demonstration activities
- Retrofit Power Distribution Panels with Production Power Distribution Chassis

HWCIs

Quantity	Part Number	Product Type
* 1	84K048XX	Real-Time Critical Network Rack Assembly
* 2	84K048XX	Display and Command Network Rack Assembly
ug 10	84K02501-XXX	Command and Control WS
ug 1	84K047XX	Data Distribution Processor Assembly
ug 1	84K047XX	Command and Control Processor Assembly
ug 1	84K047XX	Data Distribution Processor/Command and Control Processor Spare
1	84K047XX	Data Distribution Processor/Command and Control Processor Spare
* 2	TBP	Black/White Laser Printers
* 1	TBP	Color Laser Printer
* 1	TBP	Network Time Server
ug 2	TBP	SUPPORT Workstations
* 1	TBP	Network Server
* 1	TBP	RON Network Server
* 1	TBP	Network Management Workstation
* 1	84K02502-XXX	CM/Boot Server
* 1	Sun Ultrasparc W/S	Gateway Development W/S
* 1	TBP	Local OMI Server
* 1	TBP	RTPS Firewall
* 2	84K0XXXX	BIN Rack Assembly
ug 1	84K04902-0XX	CLCS GSE Gateway
1	84K04902-0XX	CLCS GSE Gateway
ug 1	84K04902-0XX	CLCS Cons. System Gateway
2	TBD	CLCS PCM D/L Gateway
2	TBD	CLCS LDB Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.5

SATELLITE DEVELOPMENT ENVIRONMENT-JSC

Product Overview:

Augment the existing Satellite Development Environment at JSC/LMSMSS for System Software and Application Software Development

HWCI Products:

Quantity	Part Number	Product Type
* 1	3Com Super Stack 3000	100baseT Switch Real-Time Critical Network HWCI
* 2	Baynetwork FDDI 2914-04	Concentrator Display and Command Network HWCI
* 12	SGI O2	HCI Development w/s HWCIs
* 1	SGI Origin 2000	Data Distribution Processor HWCI
* 1	SGI Origin 2000	Command and Control Processor HWCI
* 1	TBP	Black/White Laser Printer
* 1	3Com LANplex 2500	Edge Device - ATM to Ethernet
* 1	SGI O2	Support Server
* 1	TBD	CLCS Cons. System Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.6

SATELLITE DEVELOPMENT ENVIRNOMENT-1-PCC

Product Overview:

Augment the existing hardware in the Satellite Development Envirnoment-1-PCC to support hardware, system software and application development in either a redundant or dual string configuration.

- Upgrade Command and Control Workstation and BASIS Support Workstations with Production Hardware as required
- Upgrade all Command and Control Processor and Data Distribution Processor workstations with Production Hardware as required

HWCI Products:

Quantity	Part Number	Product Type
* 1	3Com Super Stack 3000	100baseT Switch Real-Time Critical Network HWCI
* 2	Baynetwork FDDI 2914-04	Concentrator Display and Command Network HWCI
* 6	SGI - O2/Indigo	HCI Development w/s HWCIs
* 1	SGI Origin 2000	Data Distribution Processor HWCI
* 1	SGI Origin 2000	Command and Control Processor HWCI
* 1	SGI Origin 2000	Command and Control Processor/Data Distribution Processor Spare
* 2	TBP	Black/White Laser Printers
* 1	TBP	Color Laser Printer
* 1	TBP	Network Time Server
* 2	TBP	SUPPORT Workstations
* 1	TBP	Network Server
* 1	TBP	Network Management Workstation
* 1	TBP	RON Network Server
* 1	84K02502-XXX	CM/Boot Server
* 1	TBP	Local OMI Server
* 2	TBD	CLCS GSE Gateway
* 1	TBD	CLCS Cons. System Gateway
* 1	TBD	CLCS PCM D/L Gateway
* 1	TBD	CLCS LDB Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.7

SATELLITE DEVELOPMENT ENVIRNOMENT-2-PCC

Product Overview:

Augmentation of existing hardware in the Satellite Development Envirnoment-2-PCC to support hardware, system software, and application development in a single string with redundancy or dual string with no redundancy

- Upgrade Command and Control Workstation and BASIS Support Workstations with Production Hardware as required
- Upgrade all Command and Control Processor and Data Distribution Processor workstations with Production Hardware as required

HWCIs Products:

Quantity	Part Number	Product Type
* 1	Baynetwork 350t	100baseT Switch Real-Time Critical Network HWCI
* 2	Baynetwork FDDI 2914-04	Concentrator Display and Command Network HWCI
* 6	SGI O2/Indigo	Command and Control Workstation
* 1	SGI Origin 2000	Data Distribution Processor HWCI
* 1	SGI Origin 2000	Command and Control Processor HWCI
* 1	SGI Origin 2000	Command and Control Processor/Data Distribution Processor Spare
* 2	TBP	Black/White Laser Printers
* 1	TBP	Color Laser Printer
* 1	TBP	Network Time Server
* 2	TBP	SUPPORT Workstations
* 1	TBP	Network Server
* 1	TBP	Network Management Workstation
* 1	TBP	RON Network Server
* 1	SGI O2	CM/Boot Server
* 1	TBP	Local OMI Server
* 2	TBD	CLCS GSE Gateway
* 1	TBD	CLCS Cons. System Gateway
* 2	TBD	CLCS PCM D/L Gateway
* 1	TBD	CLCS LDB Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.8

LCC-X

Product Overview:

Upgrades to the LCC-X Demonstration Center in LCC 2 to support user interface and feedback. The Gateways, Data Distribution Processor and Command and Control Processor allocated to LCC-X are physically resident in LCC 2R24/25 (i.e., with IDE-1)

- Retrofit all Command and Control Workstation and BASIS Support Workstations with Production Hardware
- Retrofit all Command and Control Processor and Data Distribution Processor workstations with Production Hardware
- Retrofit all Gateway Chassis and Single Board Computers with Production Hardware
- Install Prototype Data Recording Port
- Retrofit all equipment racks with Production Hardware, without impacting CLCS Integration and Testing activities
- Retrofit Power Distribution Panels with Production Power Distribution Chassis

HWCIs Products:

Quantity	Part Number	Product Type
ug 3	84K04505	System Engineering Console (stuffed)
ug 1	84K04510	Test Conductor Console (stuffed)
ug 2	84K04515	Console Support Module (stuffed)
ug 1	84K04520	Mission Management Console (stuffed)
ug 2	84K04525	Peripheral Housing (stuffed)
***** 1	3Com Super Stack 3000	100baseT Switch Real-Time Critical Network HWCI
* 1	Baynetwork FDDI 2914-04	Concentrator Display and Command Network HWCI
ug 1	84K047XX	Data Distribution Processor HWCI
ug 1	84K047XX	Command and Control Processor HWCI
* 2	TBP	BIN 10/100baseT Switch
ug 1	84K04902-XXX	CLCS GSE Gateway
* 1	TBD	CLCS Cons. System Gateway

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.9

SHUTTLE DATA CENTER-SERIAL 0

Product Overview:

Shuttle Data Center Serial 0 is a validation set installed to allow testing of full system software on a minimal configuration system.

- Test interface to Prototype Data Recording Port located in IDE-1

HWCIs Products:

Quantity	Part Number	Product Type

Editor note need equipment list for SDC Serial 0 Tony Perry

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.10

SHUTTLE DATA CENTER-PRODUCTION SET 1

Product Overview:

Shuttle Data Center Production Set 1 is a full up production set to perform initial operational support and user validation of the Shuttle Data Center software set.

HWCIs Products:

Quantity	Part Number	Product Type

Editor note need equipment list for SDC Production Set 1 Tony Perry

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.11 SIMULATION PRODUCTION SET 1

Product Overview:

The Simulation Production Set 1 is a full up production set to perform initial operational support and user validation of the Simulation Re-host.

HWCIs Products:

Quantity	Part Number	Product Type

Editor note need equipment list for Simulation Production Set 1 Scott Estes

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

3.12

DEVELOPMENT ENVIRONMENT PRODUCTS

These products will be shared and distributed to the various Satellite Development Environments as indicated by requirements capture.

Quantity	Part Name/No.	Product Type
* 95	SGI 02	Development Workstation
* 1	Auspex Server	Upgrade Development Environment Server for PCC
As Required	TBP	Communication Consumables: Fiber, Cable
As Required	TBP	Developer Support Items: Chairs, Desks

Equipment marked with a * is from last delivery, ug is upgrade of previous equipment

4.

HARDWARE PRODUCTS

4.1 PRODUCTION CONSOLE ENCLOSURES

The first deliveries of five types of production Console Enclosures will arrive at KSC to be deployed into equipment sets. Some of these Enclosures will be used to retrofit existing equipment installations (HMF and LCC-X) that will contain prototype consoles or tables at the end of the THOR delivery. Others will be used to build up the OCR-1 set and the SAIL set at JSC.

Production Console Enclosures will be delivered to the HMF, LCC-X , OCR-1 and SAIL sets in the following quantities:

HMF	5	System Engineering Console Enclosures (84K04506)
	4	Console Support Modules (84K04516)
	4	Peripheral Housings (84K04526)
LCC-X	3	System Engineering Console Enclosures (84K04506)
	1	Test Conductor Console Enclosure (84K04511)
	2	Console Support Modules (84K04516)
	1	Mission Management Console Enclosure (84K04521)
	2	Peripheral Housings (84K04526)
OCR-1	12	System Engineering Console Enclosures (84K04506)
	3	Test Conductor Console Enclosure (84K04511)
	10	Console Support Modules (84K04516)
	10	Peripheral Housings (84K04526)
SAIL	6	System Engineering Console Enclosures (84K04506)
	2	Console Support Modules (84K04516)
	2	Peripheral Housings (84K04526)

4.2 COMMAND AND CONTROL WORKSTATION

The production Command and Control Workstation that will be utilized operationally in CLCS will be selected as part of the THOR delivery. Command and Control Workstation quantities that will be delivered to KSC are 12 for IDE-1, 5 for the HMF, 5 for LCC-X, 6 for SAIL, 12 for the OCR-1 set, and three spares. All of these Command and Control Workstation will be dual-headed, and all of these Command and Control Workstation, with the exception of the IDE-1 workstations, will utilize flat panel monitors.

4.3 BASIS SUPPORT WORKSTATION

Additional functionality requirements may require an upgrade to the BASIS Support Workstations that are currently installed in CLCS sets. The quantity of Support Workstations that may be upgraded is 2 for IDE-1, 9 for the HMF, and 8 for LCC-X. In addition, new quantities of BASIS Support Workstations required is 8 for SAIL, 25 for OCR-1, and three spares. All of these Support workstations, with the exception of the IDE-1 workstations, will utilize flat panel monitors.

4.4 COMMAND AND CONTROL PROCESSOR/DATA DISTRIBUTION PROCESSOR

The production Command and Control Processor/Data Distribution Processor platform that will be utilized operationally in CLCS will be selected as part of the THOR delivery. The minimum Data Distribution Processor/Command and Control Processor quantities that will be delivered to KSC are 4 for IDE-1, 3 for the HMF, 2

for LCC-X, 4 for SAIL, 6 for the OCR-1 set, and three spares. The IDE-1, HMF and LCC-X units will replace development platforms that were installed by the end of the THOR delivery.

4.5 POWER DISTRIBUTION CHASSIS

The first deliveries of production Power Distribution Chassis (83K03402) will arrive at KSC to be deployed into equipment sets. Some of these Chassis will be used to retrofit existing equipment installations (HMF and LCC-X). Others will be used to build up the OCR-1 set (initial installation of the OCR-1) and the SAIL set at JSC.

Two types of Power Distribution Chassis (PDC) will be delivered. A majority of CLCS equipment will utilize the single-phase 110VAC PDC (84K03402-009). High power draw equipment, such as the Command and Control Processor and Data Distribution Processor rack assemblies, will utilize a three-phase PDC (84K03402-010) which will provide 208V for this equipment.

Single-phase, production PDCs will be delivered to the in the following quantities: 16 for HMF, 10 for LCC-X, 16 for IDE-1, 35 for OCR-1, 16 for SAIL, and five spares. Three-phase, production PDCs quantities will be 4 for HMF, 2 for LCC-X, 4 for IDE-1, 6 for OCR-1, 4 for SAIL and 4 spares.

4.6 COMMAND PANEL (TBD)

The decision as to how CLCS will provide “Programmable Function Panel” functionality (physical Command Panel .vs. virtual, on-screen) will be made as part of the THOR delivery. If the direction of the project is to a physical command panel for use in System Engineering Consoles, then a set of six First Article Command Panels will be delivered to KSC, for use in LCC-X and in IDE-1.

4.7 PRODUCTION EQUIPMENT RACKS

Production quantities of Equipment Racks (Vertical Cabinet Specification 84K03400) will be arriving at KSC during this delivery. These racks will be used to build Gateway, Command and Control Processor, Data Distribution Processor, Real-Time Critical Network, Display and Command Network and other Rack Assemblies. A total of 40 racks will be required for the SAIL and OCR-1 installations, and an additional 30 racks will be required to retrofit existing installations.

4.8 GATEWAY COMPONENTS

Production versions of Gateway equipment chassis and Gateway Single-Board computers will be arriving at KSC during this delivery. Some of these components will be used to retrofit existing equipment installations (HMF, IDE-1 and LCC-X) that will contain prototype Gateway hardware at the end of the THOR delivery. Others will be used to build up the OCR-1 set (initial installation of the OCR-1) and the SAIL set at JSC. A total of 30 chassis (with 2 SBCs each) will be required for the SAIL and OCR-1 installations, and an additional 20 chassis will be required to retrofit existing installations.

4.9 REAL-TIME CRITICAL NETWORK/DISPLAY AND COMMAND NETWORK COMPONENTS

Production Rack Assemblies of Real-Time Critical Network/Display and Command Network hardware will be created and installed as part of this delivery. Generally, the equipment installed in the IDE-1, HMF and LCC-X sets contains the correct hardware, but may need to be “re-packaged” into rack assemblies to maintain tight configuration control. Additional Real-Time Critical Network/Display and Command Network rack assemblies will be created for the OCR-1 and SAIL sets.

4.10 BIN COMPONENTS

Production Rack Assemblies of BIN hardware will be created and installed as part of this delivery. Generally, the equipment installed in the IDE-1, HMF and LCC-X sets contains the correct hardware, but may need to be "re-packaged" into rack assemblies to maintain tight configuration control. Additional BIN rack assemblies will be created for the OCR-1 and SAIL sets.

4.11 ASSORTED CLCS SERVERS

An assortment of servers, to perform, loading, initialization and connectivity functions for CLCS, will be installed as part of this delivery. A listing of these servers would include a Network Server, Boot Server, OMI Server, RON Server, and Pie Server. Generally, the equipment installed in the IDE-1, HMF and LCC-X sets contains the correct hardware, but may need to be "re-packaged" into to maintain tight configuration control. Additional CLCS Servers will be procured for the OCR-1 and SAIL sets.

4.12 CLCS TEST TOOLS

An assortment of servers, to perform, loading, initialization and connectivity functions for CLCS, will be installed as part of this delivery. A listing of these servers would include a Network Server, Boot Server, OMI Server, RON Server, and Pie Server. Generally, the equipment installed in the IDE-1, HMF and LCC-X sets contains the correct hardware, but may need to be "re-packaged" into to maintain tight configuration control. Additional CLCS Servers will be procured for the OCR-1 and SAIL sets.

Editor Note need input for prototype Test Tools Dennis Fougnie

4.13 PROTOTYPE DATA RECORDING PROCESSOR

A Pre-production version of a Data Recording Port, to provide an interface between CLCS networks and the Shuttle Data Center, will be installed into the IDE-1 set. Depending upon the maturity of the Data Recording Port design and the definition of the CLCS network-to-SDC interfaces, additional Data Recording Ports may be installed into the HMF, SAIL, OCR-1 and LCC-X Sets.

4.14 PROTOTYPE EMERGENCY SAFING SYSTEM COMPONENTS

The development of the Emergency Safing System will continue as part of the ATLAS delivery. A set of three Prototype Safing Panels will be installed into the LCC-X SE Consoles, and a prototype Safing Manager will be added to the LCC-X Control Group to interface with the Prototype Safing Panels. This delivery will concentrate on replacing the functionality of the hardwire (GSE) safing, with Vehicle Safing functionality to be covered in a future delivery.

4.15 PROTOTYPE TIMING EQUIPMENT

Editor Note need input for prototype Timing Equipment Dennis Fougnie

System Engineering Action

Documentation

- Release the Atlas System Design Document
- Provide System wide Data Flow Diagrams
- Provide System Wide Timing Allocation

Editor Note need more detail on SE&I Documents

Performance Modeling

- Capture the performance and architectural characteristics of each of the major components of CLCS.
- Analyze performance requirements and confirm that these are allocated to some portion of the system.
- Provide input to architectural trade studies by modeling configurations and identifying trouble spots as well as possible alternate designs.
- Develop a model for the Command and Control Processor, and Command and Control Workstation.
- Confirm model behavior with that of stress testing.
- Tune model to react correctly to changes in number of CPUs, CPU speed and link performance.
- Create functional blocks to represent the Gateways.
- Present results and point out any significant problem areas.
- Begin development of applications to identify other areas of concern.

Production Hardware Deployment Process

In order for this activity to be completed, a business process for managing production hardware buildup must be developed. At the present time, most CLCS subsystems and the general architecture of the system have been identified. However, the details of the system architecture, Gateway Groups, Control Groups, and Subsystems, and individual HWCIs remain to be defined. This thread will lead to production hardware engineering packages that will be used for installation and maintenance of CLCS hardware.

- CLCS production hardware build process established
- Engineering packages for IDE-1, HMF, OCR-1, and SAIL completed
- Selected Subsystem and HWCIs engineering packages completed
- Develop CLCS production hardware buildup business process
    - Establish Hardware Integration Team. Define team member roles and responsibilities
    - Develop detailed hardware buildup schedule
    - Identify major milestones in the process such as reviews.
    - Identify all required engineering documents required for each facility, subsystems, HWCIs, and all networks. Documentation should include deliverable list for each facility, engineering drawings (rack, LRU, cable, etc.), O&M manuals, vendor manuals, etc.
    - Identify all engineering disciplines (i.e. safety, security, human factors, performance modeling, etc.) required for design analysis and implementation to standards, NASA , and/or KSC policies

- Develop facility hardware engineering packages for IDE HMF, OCR-1, SAIL
- Develop engineering packages for:
    - Gateway Group
    - Control Groups
    - Flow Zones
    - All subsystems (Data Distribution Processor, Command and Control Processor, GSE, LDB, PCM, Data Recording Port, Networks, Timing Subsystem, any special test tools (such as test data Generator, LDB Monitor), etc.
    - Selected HWCIs

Open System Portability Pathfinder

- Complete limited port of Gateway software to another vendor.
- Complete port to another vendor's Data Distribution Processor 2 months after the Thor delivery.
- Complete port to another vendor's Command and Control Processor 2 months after the Thor delivery.
- Complete port to another vendor's Command and Control Workstation 2 months after the Thor delivery.
- Provide a porting report. Document the Lessons Learned from the Thor pathfinder. Define the areas of greatest impact to portability including: coding practices, processes, problematic CSCI's, and lack of common tools (compilers, linkers, libraries, etc.).
- Provide guideline to improve porting of software in the future. Recommend, acquire and integrate common tools & libraries to reduce the port and maintenance costs of RTPS system and applications software.
    - Provide a common C++ compiler at the same revision level for all platforms to be used for both C++ and C source such as the GNU C++ compiler.
    - Provide compatible debuggers (e.g GDB), profilers, etc. required to debug and test software on each platform.
- Modify the necessary processes, coding conventions and tool use requirements by updating the following documents.
    - System Software Development Plan
    - Applications Software Development Plan
    - Coding Standards Document
- Modify the Software Maintenance Cost Model to include portability for system and applications software and bring the model status up to date
- Provide a plan to migrate application & system software to the new tools & practices.

5.

PATHFINDERS

- Expert System Pathfinder

5.1 EXPERT SYSTEMS PATHFINDER

Overview:

The expert systems pathfinder will explore advisory and expert systems capabilities. The distinction in the two being that an advisory system is defined as one that analyses system problems and advises the operator. An expert system is defined as one that analyses system problems and then takes action. The software developed will be an advisory system initially. However, expert system technology will be explored later.

The HMF will be the target for this development. G2 will be used as the development tool.

As with all exploratory efforts, various aspects of this effort may meet with different levels of success. The intent here is to explore capabilities and provide a demonstration, not to provide a "ready to use" product at the end of the Atlas delivery.

Statement of Work:

- For Atlas, an advisory system which does some or all of the following will be developed:
    - Recognition and diagnosis of root causes of failures using a hierarchy tree. This implies recognition of failures such as a power bus failure when several measurements drop out.
    - Test data analysis: interpret complex curves to determine such items as leak rates and regulator performance during testing.
    - System integrity and leak detection: monitor the system while in a quiescent mode for the detection of out of spec leaks and other problems.
- The following expert system items will be explored to determine feasibility:
    - System baby-sitting with automatic securing / reconfiguration during operations such as purges and evacuation which require an engineer present currently "just in case" anything goes wrong such as a valve starting to leak. These operations may involve many possible configurations.
    - "Walking the maze": giving a "sequencer" an objective instead of a procedure. For example, an operator directs it to pressurize a particular part of the system. It determines which valves to cycle to accomplish that objective.

6.

INTEGRATED PRODUCT TEAMS

The integrated Product Team for Atlas are:

- Hypergolic Maintenance Facility IPT
- Vehicle Power-Up/Power-Down IPT
- Launch Operations IPT
- Orbiter/SRB Hydraulics IPT
- Cryogenics, Main Propulsion and FIREX Water IPT

6.1

HYPERGOLIC MAINTENANCE FACILITY IPT.

Overview:

This Integrated Product Team (IPT) is responsible for the definition, design, and development of the Hypergolic Maintenance Facility (HMF) Real-time Control Application Software. This includes software to support the check-out and maintenance of the Forward Reaction Control System, (FRCS) Aft Propulsion System (APS) and portions of the Orbiter Maneuvering System (OMS) Thrust Vector Control System . The completion of this IPT's software development will be in the post-Atlas time frame. The following Highlights and Statement of Work apply only to those items which will be worked for Atlas.

Highlights:

- Complete development of Forward Reaction Control System application software
- Complete development of Aft Propulsion System application software
- Complete validation of Forward Reaction Control System and Aft Propulsion System application software (post Atlas)

Statement Of Work

- Continue development of the Forward Reaction Control System and Aft Propulsion System Application software:
    - Finalize the Aft Propulsion System Functional Requirements Document
    - Finalize Forward Reaction Control System / Aft Propulsion System Software Design Specification
    - Complete Forward Reaction Control System / Aft Propulsion System Display development and integration with End Item Managers
    - Complete Forward Reaction Control System / Aft Propulsion System End Item Managers and automated Sequencers
    - Perform unit and integrated testing of Forward Reaction Control System / Aft Propulsion System software against an SGOS model
    - Prepare final validation test plans and procedures.
- Perform development of the Guidance (GUI) OMS TVC application software that is used during HMF operations:
    - Finalize GUI Functional Requirements Document
    - Finalize GUI Software Design Specification
    - Complete GUI display, End Item Manager and Sequencer
- Prepare final validation test plans and procedures
- Develop OMI and TPS updates.

6.2

VEHICLE POWER UP / DOWN IPT

Overview:

This Integrated Product Team (IPT) is responsible for the definition, design, and development of the Real-Time Control Application software to support the automated power up/down of the Space Shuttle. The includes the auto power up/down sequence which is required by the Test Project Engineer (TPE), and the supporting subsystem software for the following systems: Data Processing System (DPS), Environmental Control and Life Support System (ECL), Electrical Power and Distribution System (EPD), Instrumentation System (INS) and Integrated Operations (INT). This Application Software not only includes power up/down sequence functionality, but the components required by these systems to monitor GSE and Flight Hardware when that hardware is active. The completion of this IPT's software development will be in the post-Atlas time-frame (scheduled completion is Titan). The following Highlights and Statement of Work apply only to those items which will be worked for Atlas.

Highlights:

- Develop ECL, EPD, INS, and DPS application software required to support power application activities
- Develop integrated Displays and Sequencers to support power up/down activities

Statement Of Work

- Finalize the Functional Requirements Document sections of the following CSCIs that apply to the power up/down activities: ECL, EPD, INS, DPS, and INT.
- Start development of the integrated operations application software
    - Develop the Software Design Specification sections of the following CSCIs that apply to the power up/down activities: ECL, EPD, INS, DPS, and INT.
    - Develop required system and integrated Displays and integrated End Item Managers and Sequencers
    - Develop automated Sequences for power-up and power-down tasks.
- Begin development of validation test plans and procedures
- Evaluate OMI and TPS updates.

6.3

LAUNCH OPERATIONS IPT

Overview:

This Integrated Product Team is responsible for the definition, design and development of the automated Ground Launch Sequencer (GLS) and related launch operations application software. The completion of this IPT's software development will be in the post-Atlas time-frame (currently scheduled for Saturn). The following Highlights and Statement of Work only apply to those item which will be worked for Atlas.

Highlights:

- Establish the goals and objectives of the launch operations development

Statement Of Work

- Conduct launch operations philosophy discussions to establish the foundation for the Ground Launch Sequencer and related launch operations tasks for the CLCS environment.
    - Review activities from T-6 hours post-launch securing
    - Explore changing roles during launch countdown during the T-6 through T-0 time-frame
    - Evaluate today's tasks and determine what is good to keep and what can be changed to improve operations
- Define the top three strategies for launch operations and begin discussions on their merits and disadvantages.
- Evaluate OMI and TPS updates.

6.4

ORBITER/SRB HYDRAULICS IPT

Overview:

This Integrated Product Team is responsible for the definition, design and development of the Real-Time Control Application Software to support the checkout and operations of the Ground Support Equipment (GSE) functions for the Orbiter and SRB Hydraulics systems. The completion of this IPTs software development will be in the post-Atlas time frame (currently scheduled for Titan).The following Highlights and Statement of Work apply only to those items which will be worked for Atlas.

Highlights:

- Development of the Real-Time Control Application Software required for the checkout and operation of the Orbiter and SRB Hydraulics GSE

Statement Of Work

- Develop the Orbiter (HYD) and SRB (BHY) Hydraulics GSE application software:
  - Develop and finalize the GSE sections of the Functional Requirements Document
  - Develop and finalize the Software Design Specification for each system
  - Complete Display development and integration with End Item Manager for each system
  - Begin development of validation test plans and procedures for each system
- Perform validation testing of HYD and BHY application software against an SGOS model (post-Atlas)
- Evaluate OMI and TPS updates.

6.5

CRYOGENIC, MAIN PROPULSION SYSTEM ,AND FIREX IPT

Overview:

This Integrated Product Team is responsible for the definition, design and development of the Real-Time Control Application Software to support the checkout and operations of the Ground Support Equipment (GSE) functions for the Liquid Hydrogen (LH2), Liquid Oxygen (LO2), Main Propulsion System (MPS) and FIRE Water (WAT) systems. The completion of this IPT's software development will be in the post-Atlas time frame (currently scheduled for Scout). The following Highlights and Statement of Work apply only to those items which will be worked for Atlas.

Highlights:

- Definition of the Real-Time Control Application Software required for the checkout and operation of the LH2, LO2, MPS and WAT GSE.

Statement Of Work

- Begin development of the LH2, LO2, MPS and WAT GSE applications software.
    - Develop and finalize the GSE sections of the Functional Requirements Document for each system
    - Develop the Software Design Specification for each system.
    - Begin Display development and integration with End Item Managers for each system
- Begin End Item Manger and automated Sequencer development for each system.
- Evaluate OMI and TPS updates.

7.

SYSTEM TEST CASES

The System Test Cases are:

- System Capability Demonstration Phase 2 Test Case
- System Test Phase 1 Test Case

7.1

SYSTEM CAPABILITY DEMONSTRATION 2 TEST CASE.

Overview:

This test case will build on the Thor demonstration of System Capability. It will demonstrate capability to run application software. This demonstration will show the aggregate delivered capabilities (through the Atlas Delivery) of the CLCS. Real Time Control Applications Software (non-validated) will be used to confirm the CLCS command, control and monitoring concepts are solid and that the support infrastructure is ready to support future Real Time Control Applications Software development. Capabilities not directly related to Real Time Control Applications Software will be demonstrated using viewers and other applications developed for those CSCIs (e.g., Shuttle Data Center data retrieval applications).

Highlights:

- Provide a demonstration of application software running with SGOS Models on the Central Data System (CDS) thru the Video Simulation Interface.(Gateway & Foundation)
- Provide a demonstration of application software running with SGOS Models on the Simulation Re-platform Host thru the Simulation Gateway.(Support Thread)
- Provide a demonstration of application software running with SGOS Models on the Simulation Re-platform Host thru the Video Simulation Interface. (Support Thread)
- Provide a demonstration of data retrieval and analysis from the Shuttle Data Center.(Support Thread)
- Provide demonstration of Launch Data Bus Activities.

Assumptions

The following assumptions are made to preclude additional project costs just to produce a demonstration product:

- The demonstration will take place two to three months post Atlas delivery to provide sufficient time for inclusion of system capabilities delivered in Atlas to be implemented in application software.
- Validated Applications Software is not required for the demonstration. Applications software support provides the mechanism to demonstrate system capabilities.

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Demonstrate all aspects of Application Software's use of the system capabilities to provide vehicle/GSE checkout functions. An SGOS simulation math model (via the simulation gateway, VSI or other connection) will be used to provide "end item destinations".
    - Command and Control Workstation and End Item Manager command communications

- End Item Manager to End Item Manager command communications
- Command Processor to End Item Manager command communication.
- Command Processor to FD command communication.
- Command and Control Workstation and End Item Manager command authentication
- Automated sequence command communications
- Derived/Fused FD addition to the Data Distribution stream
- Setting/Responding to Application Software asserted constraints
- Prerequisite Control Logic performance
- Reactive Control Logic performance
- Logging, Recording and Retrieval of CLCS measurements, command, messages and packets.

- Demonstrate capabilities for data retrieval and analysis from the Shuttle Data Center by way of Support Workstation, and Command and Control Workstation.
- Demonstrate capabilities of all available System Viewers:
  - Data Health Viewer
  - Data Fusion Viewer
  - Constraint Viewer
  - Subsystem Health Viewer
  - System Message Viewer
  - Subsystem Integrity Viewer
  - System status viewer
- Demonstrate PCM downlink interface and LDB capabilities using Application Software Interfaces to demonstrate.
- Demonstrate Display support for the following consolidated data systems:
  - METRO
  - Fuel Cell
  - Integrated Vehicle Health Management
  - GMS
- Demonstrate System Check Pointing.

7.2

CLCS SYSTEM TEST — PHASE 1 TEST CASE

Editor Note this thread to be worked as part of DP1 Ken clark

Overview:

This thread provides a comprehensive approach to automatic and semi-automatic testing of CLCS functional capabilities. The thread is intended to encompass levels of testing from early CIT through System Level Testing. Specifically the following areas are covered:

- CSCI Integrated Testing
- System Level Testing
- Regression Testing
- System Stress and Performance Testing

The objective of the thread is to:

- Develop a thorough and detailed understanding of what automated and semi-automated procedures will be used to validate CLCS requirements.
- Establish the requirements and top level design for the "End State" test applications and test procedures.
- Develop and implement Sets of automatic test applications and semi-automatic procedures to test Atlas software.
- Begin an "In Process Inspection" of requirements implemented to date on the CLCS System to determine the level of correct implementation of those requirements.
- Develop and get agreement with users on exactly what is required for user acceptance of the Atlas System Software and user applications.
- Develop the set of automatic test applications and semi-automatic procedures to verify that the Atlas software is ready to support HMF operational testing.
- Continue development work on Stress and Performance Testing. Determine how these tests are used in the overall test methodology.
- Continue work to identify and acquire regression test tools. Determine how and to what extent these tools are used in the overall test methodology.

Highlights:

- CLCS CIT through System Level Test Implementation Methodology will be established.
- End State CIT, Regression Test, System Stress and Performance Tests, and System Level Test Suite(s) are defined and development has begun.
- TCID requirements for CIT, Regression Test, System Stress and Performance Tests, and System Level Test Suites are defined and in use for Atlas testing.
- Test Applications are developed to test Atlas required capabilities for "In Process" Inspections.
- Test procedures and automatic test applications are defined and in place to support user acceptance of HMF operational software.

Definitions:

CSCI Integrated Test — CSCI Integration Test's (CIT's) are performed by the software developer (with support from the System Integration group) to verify basic functionality and successful integration of a functionally complete set of programs (e.g., CSCI's, such as Application Software, Application Services, System Services) with its new and/or modified units in an operational like environment. CIT's are the final tests against Functional Requirements and are the final level of testing prior to System Tests.

Informal Test — Informal tests are tests that are performed against hardware, software, or integrated products without requiring semi-formal or formal processes. Informal tests have the following attributes:

- A written procedure is optional
- Deviations from procedure may be made with out paperwork or approval
- Witnessing of steps is optional
- Report of test conduct is optional
- Assessment of the outcome is optional

In-process Inspection — In-process Inspection is a semi-formal inspection of products developed or integrated by the CLCS team to determine that the products are meeting requirements. These inspections are performed during the interim deliveries of software and hardware to determine the degree of compliance of the products to requirements. They are performed by the System Test Group and witnessed by SM&QA.

Formal Test — Formal tests are those that are performed against hardware, software, or integrated products with a high degree of test discipline. Formal tests have the following attributes:

- A Signed written procedure is required.
- Deviations from procedure require the proper paperwork to be complete and signed by an authorized person.
- All steps are witnessed by SM&QA.
- A report describing the test conduct is generated.
- An assessment of the outcome of the test is made.

Performance Test — Performance Tests are tests that are designed to determine the performance of a particular product or set of products.

Regression Test — Regression Tests are tests that are performed against previously delivered products to determine if newly developed products cause the previously delivered products to fail to meet functional or performance requirements that they previously met. A secondary objective is to determine if the newly developed products cause the previously released products to behave in a manner that is undesirable even though they still meet requirements.

Semi-formal — Semi-formal tests are tests that are performed against hardware, software, or integrated products that require a higher degree of formality than informal tests, but not as much as formal tests. Semi-formal tests have the following attributes:

- A Signed written procedure is required.
- Deviations from procedure may be allowed without written paper or authorization.
- Witnessing of steps is optional.
- Report generated is optional.
- Assessment of the outcome is optional.

Stress Test — Stress Tests are tests that are designed to stress the system or a particular set of products within the system to determine if the test article meets requirements under the load imposed by the test. As a side result Stress Tests are often used to determine if there are points where the test article no longer meets requirements or "breaks" in some manner and to establish what those loads are.

System Level Test — The System Tests are performed by the System Test team (which is a subset of the System Integration and Test group) to verify successful integration of a system delivery and to demonstrate that the

system is “operable” in all required modes (e.g., development, maintenance, system operations, test/launch support, etc.).

Statement Of Work

- Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:
    - Whether the requirement is incorporated into the Atlas release,
    - The level of maturity the requirement will achieve in Atlas
        - Low = function only implemented in one subsystem,
        - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
        - High = function is implemented nearly everywhere, or
        - Complete = function is implemented everywhere that it is needed
    - If the requirement will have to be verified for HMF to be declared operational
- Define what automatic and semi-automatic test cases have to be built to validate that the requirements of the CLCS system have been met.
- Develop the top level design for the "End State" CIT, Regression Test, System Stress and Performance Tests, and System Level Test Suites.
- Determine what TCID(s) will be used in each of the test scenarios.
- Develop the detailed requirements and design of the Atlas CIT, Regression Test, System Stress and Performance Test, and System Level Test.
- Determine what boundary conditions must be tested for each requirement to verify successful implementation.
- Develop the Atlas requirements document for CIT and System Test.
- Begin development of the End State CIT, Regression Test, System Stress and Performance Test, and System Level Test Suites and complete the development of the Atlas test cases.
- Use the selected TCID(s), Atlas Test Suites, and Atlas Test Procedures in Atlas CIT and System Testing to provide an "In Process Inspection" of the requirements implemented to date.
- Provide a report to Program Management detailing the state of requirements implemented through Atlas.

Requirements from SLS:

- (Proposed) A set of automated programs and manual procedures shall exist to verify that the CLCS software meets required functionality. [Partial]
- (Proposed) A method of tracking CLCS requirements to System Level test shall exist in order to determine that required CLCS functionality is tested. [Partial]

7.2.1 System Stress Test Phase 2

This test case will evaluate if the CLCS architecture will be able to support system load conditions. This thread will build on the Thor work.

Statement Of Work

- Perform Stress Test developed in Thor on Thor Baseline.
- Perform Test with Atlas Baseline.

- Simulate using real Gateways, 5 Ground Support Equipment busses, 1 PCM Down Link, 3 Space Shuttle Main Engine links and 1 Launch Data Bus running at rates up to all data changing.
- Utilize a test TCID with:
    - 100 to 200 test FDs
    - Data for 1 format of PCM downlist FDs
    - Shuttle Main Engine FDs
    - HMF FDs
    - Selective Launch data Bus Command FDs
- Provide a group of simple Data Fusion functions for 100 of the test FDs
- Provide a set of SGOS models to drive test FDs.
- Provide a group of test End Item Managers, to support system testing based on Thor developed End Item Managers.
- Perform testing of Recording Interface.
- Build two End Item Managers that respond to Ground Support Equipment inputs.
    - Schedule with Constrain Notification and/or timer.
    - When input Discrete changes output a command to set Discrete output
    - When input Discrete changes output a command to look for input to change back.
    - Increment a counter.
    - Cross connect output from on End Item Manger to input for other.
- Perform testing of Gateway performance.
- Provide performance data for system modeling.
- Provide a mechanism to increase load beyond the performance requirements.

Performance Requirements from SLS

- The system shall support 25, 000 End-Item Function Designator changes per second continuously. This is the “system maximum data bandwidth”. [Complete]
- The system shall support a peak of 50, 000 End-Item Function Designator changes in a given second without losing any data [Complete]
- RTPS shall be able to support full Uplink command rates on the following links: [Complete]
    - Ground Support Equipment - 500/second.
- The Data Health Function shall support the “system maximum data bandwidth”. [Complete]
- The Data Fusion function shall support the “system maximum data bandwidth” with one fusion calculation per End-Item Function Designator change. [Complete]
- The Display function shall, for a single workstation, support updating 50% of the FDs every second on 13 windows with 100 FDs in each window [Complete]
- Each Command and Control Processor shall support 5 End-Item System test applications, with 6 test applications for each System (30 Processes) with each test application executing 500 Application Service calls per second (15, 000 calls/second) while executing at 5 percent of the system maximum data bandwidth (TBD). The ratio of application service calls are 45 local application services (read, if, compare, etc.), 4 constraint management notification changes and 1 command for every 50 calls. The test applications are to be the same priority level and each is allowed to execute at least 10 times per second. [Complete]

7.2.2 Regression Testing Phase 2

The purpose of this Test Case is to activate regression testing, procedure, tools and database as part of the CLCS project.

Overview:

Provides an integrated set of testing tools and procedures to form the basis of repeatable, automated and efficient regression tests for system and applications software for RTPS.

The term regression test is meant to describe a full test of a component or system at a sufficient level to verify that it meets functional or interface requirements. The test is defined in a repeatable automated test script. The test cases and test results are captured to a test report file. The current test report file is compared to a previous accepted test run obtained from the CM Repository. If there are no differences, the test is successful. If there are differences, the differences are reviewed and determined to be correct or to document outstanding problems. If the differences are correct, the test run can be saved at the appropriate point into the CM Repository as the new accepted run. If the differences are incorrect, a problem exists and requires attention. The process of running a regression test against a modified system or component ensures that the capability has not "regressed" and continues to meet both old and new requirements. A necessary part of adding or modifying software capability is to augment the regression test script to continue to ensure full coverage.

Efficiency (and therefore automation) of regression testing is critical. This determines whether the CLCS test organization can afford the time to run both the detailed (component and unit) on elements that have changed, and also afford to regularly run all system level regression tests.

Statement of Work:

- Provide a set of Regression Test tools for testing RTPS system and applications software including the testing of COTS products.
- Use COTS products where practical.
- Provide coverage for the following

	Call Based Testing	GUI Based Testing
CCWS	X	X
DDP/CCP	X	
Gateway	X	
DDE	X	X
RTPS System Software Dev W/S UNIX(SGI,TBD), PC	X	
RTPS App Software Dev W/S UNIX (HP), PC	X	

- Minimize the impact on GUI based test scripts cause by the relocation and resizing of cursor targets on the GUI under test.
- Support component, unit, and system level testing.
- Support developer, integration, and user testing of the same element.
- Integrate Regression Test management with definitions and test results in the CM Repository.
    - Storage of regression test scripts and accepted test results
    - Maintenance of all forms of regression test scripts
    - Execution of test scripts in development mode (local) and test mode (CM Repository) resulting in the creation of a local ASCII text file containing the test results
    - Provide comparison and differences between the current test run and a previously accepted test run in development mode (local) and test mode (CM Repository)
    - Accept a current run and replace the previously accepted run both in development mode (local) or test mode (to the CM Repository)

Demonstrate regression test support by accomplishing the following:

- GUI Based Testing
    - Provide regression testing for all Atlas Command Processor FD based commands.
    - Provide regression testing for a Atlas scheduled Applications S/L user display.
- Call Based Testing
    - Provide regression testing for all Atlas Application Services/ FD Services API calls.

Requirements from SLS

- The RTPS shall provide regression test support for all User Applications. [Review]
- The SDC shall provide the capability to manage Regression Test Products and

8.

ATLAS THREADS

8.1 GATEWAY INTERFACES THREAD GROUP

The Gateway Interface Threads are:

- PCM/ SSME Support Completion Thread
- Launch Data Bus Interface Phase 2 Thread
- Hardware Safing System Thread
- System Timing Thread
- IVHM, Record Playback Subsystem, Hazardous Gas, and other Consolidated Data Thread

8.1.1

PCM Down Link Support Completion Thread

Overview:

This thread provides a fully functional PCM Down Link Gateway. This is needed to allow delivery of the Power Up/Down IPT in the Titan delivery.

The Space Shuttle Main Engine, Pulse Code Modulation (PCM) downlink interfaces consists of three separate one-way telemetry data streams from the Space Shuttle Main Engine Controllers (SSMEC) via the Engine Interface Units (EIU). This downlink is the primary method for the Space Shuttle Main Engines to communicate measurements, health, and status to the ground system.

Highlights:

- Bring the PCM Down Link Gateway to full operational status.
- Support all data types.
- Support changes in operational modes.

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Provide the capabilities required to support all PCM FDs.
- Provide support for 128 kbits OI/GPC, and Space Shuttle Main Engine 60 Kbits links.
- Provide the capability to detect and report PCM Link Errors and update the FD Status appropriately.
- Add support for modification of Calibration Coefficients of selected FDs.
- Provide the capability to load/reload the PCM Down Link Gateway Tables in the Gateway.
- Provide the capability to record and retrieve the PCM Down Link FDs via Shuttle Data Center.
- Provide the capabilities required to support display of all PCM Down Link FDs.
- Provide support for super commutated Space Shuttle Main Engine FDs
- Provide a user display capability to display all PCM Data Types
- Build, load, distribute, and initialize all TCID table and SCID software required to support PCM Gateway operation.

Requirements from SLS

- All gateways shall be able to support full link bandwidth with all values changing every sample. [Complete]

- The RTPS shall provide the capability to receive, decommutate, and process PCM downlink information from the PCMMU as described in: [Partial]
    - ICD-2-0A003, Flight Vehicle/LPS Computational Systems Interface [Partial]
    - ICD-2-19001, Shuttle Orbiter/Cargo Standard Interfaces [Partial]
    - SS-P-0002-140, Space Shuttle Downlist/Uplink Software Requirements [Partial]
- The RTPS shall provide the capability to receive, decommutate, and process payload PCM downlink information as described in: [Partial]
    - ICD-2-0A003, Flight Vehicle/LPS Computational Systems Interface [Partial]
- The RTPS shall provide the capability to receive and process PCM downlink information from the three Space Shuttle Main Engine Controllers as defined in: [Partial]
    - ICD-2-0A003, Section 5, Flight Vehicle/LPS Computational Systems Interface. [Partial]
- The RTPS Gateway shall be capable of interfacing to a minimum of three SSME PCM data sources (hardline, and two RF sources) per SSME link simultaneously, with only one of the sources being actively processed. [Complete]
- The Orbiter is capable of providing other downlink data streams in addition to the OFI and SSME. These downlinks are processed in CCMS by the Common Downlink (CDL) FEPs and are usually referred to as CDL data or independent data streams. The downlinks are generally payload related and range from 10 bits/sec to 64 Kbs. [Reference]
- The RTPS shall provide the capability to receive and process payload PCM downlink information from Orbiter as defined in: [Partial]
    - ICD-2-0A003, Flight Vehicle/LPS Computational Systems Interface [Partial]
    - NSTS-21000-A04, Standard Integration Plan Annex No. 4, Command and Data Requirements [Partial]
- The RTPS shall be capable of interfacing to a minimum of three Other Orbiter PCM data sources (hardline, and two RF sources) per PCM link simultaneously, with only one of the sources being actively processed. [Complete]
- All subsystems (except workstations and Ground Support Equipment Link Gateways) shall be synchronized to Range Time within TBD microseconds to support 1 millisecond time-stamping of measurements. [Complete]

Other System Requirements

- The system shall provide a method for reading the current value of an analog FD in raw counts. [Complete]
- The system shall provide a method for reading the current value of a discrete FD in unprocessed format. [Complete]
- The system shall provide a method for changing the significant change value of any analog FD. [Review]
- The system shall provide a method for changing the stale data count for any FD. [Review]
- The system shall provide a method for changing calibration coefficients. [Complete]
- The system shall provide a method to activate or inhibit stale data checking on a per FD basis. [Review]
- The system shall provide a method of reading the current sample rate of an FD. [Complete]
- The system shall provide a method to activate or inhibit data acquisition at any gateway. [Partial]

- The system shall provide a method to activate or inhibit data processing at any gateway. [Partial]
- The system shall provide a method to read the data acquisition status of any gateway. [Partial]
- The system shall provide a method to read the stale data check processing status of any gateway. [Review]

8.1.2

Launch Data Bus Interface Phase 2 Thread

Overview:

This thread builds on the initial capability to monitor and command the Launch Data Bus (LDB). LDB is the interface between the Orbiter data processing system and all applicable ground facilities for test, checkout, maintenance, preflight, and post-flight phases. In addition, this common software interface provides the RTPS with access to the devices that are attached to the Launch Data Bus when the General Purpose Computers (GPC) are not active on the Launch Data Bus.

Highlights:

- DIO Mode Operations
- Load Register Command
- Arithmetic Command
- EIU Read/Command Operations
- MEC Read/Command Operations
- Critical Command Handling for effected commands
- MMU Capability 1 Operations
- Dual LDB Gateway Configuration
- DEU Read Commands
- Initial LDB Active/Standby Communication Development

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- A basic MDM simulator will be developed to provide simulated Command Decoder responses. The MDM simulator will be able to operate as Remote Terminal units attached to the Launch Data busses. The MDM simulator will provide limited error injection capabilities. The MDM simulator will be used to verify Launch Data Bus gateway DIO mode operation in a standalone environment.
- TCL shell based GUIs will be developed to configure and control the GPC and MDM simulator systems for standalone LDB testing.

- A single-string non-redundant Launch Data Bus Gateway prototype will be developed with Direct I/O (DIO) mode operations capability. This enhanced LDB gateway will be able to act as bus commander in control of the Launch Data Bus. It can then be transitioned to the normal remote terminal mode of operation where the GPC is in control of the bus. Supporting software will be developed that will format commands suitable for communicating with Command Decoder MDMs resident on the Launch Data Busses when the Orbiter GPCs are powered down.
- A single-string non-redundant Launch Data Bus Gateway prototype will be developed which will operate in the Dual LDB configuration. This Dual LDB will be able to lock itself to a single Data Bus and will primarily be used for Mass Memory operations. Features will be added to the single-string active LDB gateway to allow it to be locked to a single, different, bus to prevent multiple responders on the same bus.
- Orbiter Computational Facility (OCF) features will be developed to support Mass Memory and DEU Dump/Compare capabilities.
- Mass Memory Unit (MMU) Capability 1 support will be implemented for Atlas. MMU Capability 2 and SSME Load Program (SLP) support will be provided post Atlas.
- The following additional SACS and TCS-1 commands will be implemented:

Route Code	Request ID	150 OP Code	Operator	Description
11	tbd	21	LOAD REG	Loads TCS Registers
11	tbd	23	ARITHMETIC	Performs arithmetic operations on TCS Registers
11	tbd	18	EIU READ	Read operations on EIU
11	tbd	17	EIU CMD	Commanding to EIU
11	tbd	20	MEC READ	Read operations to MEC
11	tbd	19	MEC CMD	Commanding to MEC

- Launch Data Bus Gateway tables will be refined and extended to support additional Atlas features. Launch Data Bus Gateway hardwire safing tables and initialization will not be developed for Atlas.
- Provide application services required to support display of Launch Data Bus data .
- Build, load, distribute, and initialize all TCID table and SCID software required to support Launch Data Bus operation for Atlas.
- An initial approach and preliminary software will be developed for Launch Data Bus Gateway Active/Standby Synchronization Communication will be developed. The Atlas implementation will be used primarily for obtaining quantitative measures of performance necessary for finalizing Redundancy Management and Switchover capabilities post Atlas.

Requirements from SLS

- The RTPS shall meet the requirements allocated to the LPS/LDB interface specified in:
  - SS-P-0002-150, Space Shuttle LDB Software Interface Requirements
  - ICD-2-0A003, Section 3, Flight Vehicle/LPS Computational Systems Interface [Partial]
- The RTPS shall provide the capability, in GPC Mode, to issue commands and to receive measurement data, via the GPCs, from:
  - Orbiter Multiplexers/Demultiplexers (MDM) (i.e., Flight Critical, Payload, Flex, SCA, and Command Decoders) [Partial]
  - Master Events Controller (MEC) [Partial]

- *Pulse Coded Modulation Master Units (PCMMU) (Post ATLAS) [Reference]*
- Mass Memory Units (MMU) [Partial]
- *SSME Controllers (Post ATLAS) [Partial]*
- Solid Rocket Booster (SRB) MDMs [Complete]
- Engine Interface Units (EIU) [Partial]
- *Payload Data Interleaver (PDI) (Post ATLAS) [Reference]*
- *Payload Signal Processor (PSP) (Post ATLAS) [Reference]*
- *Space Lab (SL) Experiment/Subsystem Computers (Post ATLAS) [Reference]*
- Display Electronic Units (DEU)

- The RTPS shall provide the capability, in Direct Input/Output (DIO) Mode (i.e., when the GPCs are not active), to issue commands to and receive measurements from:
  - Solid Rocket Booster MDMs [Complete]
  - Command Decoder MDMs [Complete]
- The RTPS shall provide the capability to interface with all GPC Functional Destinations available via the LDB.
  - Systems Software Avionics Command Support (SACS) [Complete]
  - Test Control Supervisor Single Commands (TCS-1) [Complete]
  - Mass Memory (MM)/Display Electronics Unit (DEU) Read [Partial]
  - *Space Shuttle Main Engine (SSME) Load Program (SLP) (Post ATLAS) [Partial]*
  - *Launch Sequence (LS) (Post ATLAS) [Partial]*
  - *Test Control Supervisor Test Sequences (TCS-S) (Post ATLAS) [Reference]*
  - *Continuation of previous TCS-S sequence containing the same transaction ID (Post ATLAS) [Reference]*
- The RTPS shall provide the capability to load, modify, dump, and verify the memory of Space Shuttle computers according to the following matrix:

Function	GPC Main Memory (PASS and BFS)	Mass Memory	DEU Memory	PCMMU	SSME
Load		X[Reference]			X[Reference]
Dump	X[Complete]	X[Complete]	X[Complete]	X[Reference]	X[Reference]
Verify	X[Reference]	X[Reference]	X[Reference]	X[Reference]	X[Reference]
Modify	X[Complete]	X[Complete]			X[Reference]

- The system shall provide the capability for a single test (control) application to queue multiple LDB commands to support every LDB command opportunity [Complete]
- RTPS shall be able to support full Uplink command rates on the following links:
  - LDB - 8/second [Complete]

Other System Requirements

- 4.2.1.1.1 The system shall provide a method to issue values to analog output FD's to support on-board port/MDM specifications. [Complete]
- 4.2.1.5 The capability shall be provided to support on-board/MDM specifications in discrete commands. [Complete]
- 4.2.2.2 The system shall provide a method for reading the current value of an analog FD in raw counts. [Complete]

- 4.2.2.5 The system shall provide a method for reading the current value of a discrete FD in unprocessed format. [Complete]
- 4.2.4.3.4 The system shall provide a method for changing calibration coefficients. [Complete] [Review]
- 4.3.1.3 The system shall provide a method to activate or inhibit command issuance by any gateway. [Complete]
- 4.3.2.2 The system shall provide a method to read the data acquisition status of any gateway. [Complete]
- 4.10.2 Functionality shall be provided to request an MDM or FLEX MDM to perform an internal function. The following functions shall be supported: (Reference KSC-LPS-OP-033-4 Section 3.2.3)
    - 4.10.2.1 Master Reset [Complete]
    - 4.10.2.3 Perform BITE Tests 1, 2, 3 and 4 [Complete]
    - 4.10.2.3 · Load the BITE Status Register [Complete]
    - 4.10.2.4 · Perform a Wrap Test [Complete]
- 4.10.3 Functionality shall be provided to communicate with the Master Event Controller BTUs and to command their test and control functions. The following functions shall be supported: : (Reference KSC-LPS-OP-033-4 Section 3.2.4)
    - 4.10.3.2 · Master Reset [Complete]
    - 4.10.3.3 · Wrap Test [Complete]
- 4.10.6 Functionality shall be provided to perform "read" operations on the following on-board components. The reads return response data words from the specified component. (Reference KSC-LPS-OP-033-4 Sections 3.3.2 through 3.3.6)
    - 4.10.6.2 · Multiplexer/Demultiplexer [Complete]
    - 4.10.6.3 · Master Events Controller [Partial]
    - *4.10.6.4 · Pulse Code Modulation Master Unit(Post Atlas) [Reference]*
- 4.10.7 Functionality shall be provided to control the LDB I/O functions performed by the GPC. This capability shall cause the desired request to be sent to the GPC which is currently communicating with the LDB gateway so that the current mode and/or control p
- 4.10.19 Functionality shall be provided to control the SRB MDM’s (lock/unlock). (Reference KSC-LPS-OP-033-4 Section 6.0) (Post Atlas) [Reference]

8.1.3

Hardware Safing System Phase 1 Thread

Overview:

This thread provides the initial hardware safing system design and prototype units. The Hardwire Safing System provides an alternate means of controlling and monitoring critical GSE in the event of a failure of the RTPS. This consists of mostly hardwired 28V lines that perform two functions: cut-off the power to selected HIMs, thereby returning their outputs to a zero (de-energized) state; and provide direct control and monitoring of selected GSE components. The RTPS must provide a totally separate system that provides the capability to bypass the primary Command and Control system. This system is referred to as the RTPS Safing System and consists of two major areas: Vehicle Safing and Hardwired Safing. Both areas have Safing Panels at the System Engineering Consoles. Hardwired Safing is connected directly to sensors and effectors at the test site (e.g., PAD, VAB, etc.). In CCMS, Vehicle Safing is connected to the LDB Gateway only at the PADs and SAIL. CLCS shall not preclude the addition of other sites in the future, where Vehicle Safing Sequences are loaded and executed. Vehicle Safing is connected to the OFI PCM Downlink in order to acquire measurement data to be displayed on the panels.

Highlights:

- Develop and prototype Hardware Safing Panels
- Deploy in LCC X

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Provide system design for safing at all facilities.
- Develop Hardware Safing Panels
- Prototype Hardware Safing Panels
- Evaluate COTS Hardware Safing Panels
- Deploy in Hardware Safing Panels LCC X
- Gather user feedback.
- Design interface hardware to CCMS hardwire safing system.
- Prototype interface hardware to CCMS hardwire safing system.
- Begin design of ESS Safing Manager
- Develop ICDs BioMed\Vehhical Safing and Launch Data Bus Safing.

Requirements from SLS

- The RTPS shall be capable of accepting 28V discrete and analog signals from the Hardwire Safing System.

- The RTPS shall be capable of outputting 28V discrete and analog signals to the Hardwire Safing System. [Reference]
- The RTPS shall interface to the existing Hardwire Safing System at the Hardwire Safing Patch Panel using Pad, OPF, and VAB wiring, sensors and effectors. [Reference]
- The RTPS Safing System shall provide a totally independent Safing capability for the emergency control and monitoring of critical and/or hazardous systems. [Reference]
- The RTPS Safing System shall provide the capability to place the Test Article and support equipment in a safe state. [Reference]
- The Safing System panel shall be easily re-configurable to support movement of the function from one Console Position to another. [Reference]
- A Safing panel shall be provided at every command and control console position in the LCC Set. (Reference only) [Reference]
- Hardwired Safing shall provide direct GSE effector control from the Safing System. [Reference]
- Hardwired Safing feedback data shall be accomplished by GSE sensors returning hard-wired voltages directly to the Safing System. [Reference]

8.1.4

System Timing Thread

Overview:

This thread provides synchronization with Coordinated Universal Time, the generation of Countdown Time, and Mission Elapsed Time, and supports to the Time Management Distribution Systems

The Coordinated Universal Time (UTC) interface receives UTC from the facility Timing Terminal Unit in IRIG-B123 format and processes the input data stream for distribution within CLCS.

Countdown Time (CDT) and Mission Elapsed Time (MET) are generated by the RTPS and used by various components of CLCS and external users as a reference for the current time within the countdown or mission. CDT becomes MET when time passes from minus time to positive time.

The Time Management Distribution System (TMDS) allows the RTPS to drive various hold-time-remaining clocks. In CCMS, this is accomplished by a set of discrete outputs (i.e., a HIM chassis and card) located in the Common Data Buffer timing rack.

Highlights:

- System wide timing

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Provide for input of UTC into the RTPS system
- Provide for output of CDT and MET to other external users in IRIG format
- Provide for output of CDT, MET and GMT to drive displays
- Provide design for management of time remaining clocks.
- Provide design for the capability to synchronize Greenwich Mean Time (GMT) on board the Orbiter’s Master Timing Unit (MTU) to Universal Time Coordinated (UTC) with an accuracy of less than or equal to one millisecond
- Provide the capability to switch to local time both for the test set and on a subsystem basis.
- Resolve time tagging design for
    - GSE Gateway
    - PCM Down Link
    - Other Gateways
    - Command and Control Processor
- Provide services to allow references when using time to convert to:
    - CDT

    - TREF
    - Time from Present
    - Orbiter GPC Time
- Investigate need for simulation time and use of subsystem time

Requirements from SLS

- The CLCS shall be capable of accepting and processing a continuous IRIG-B123 signal as defined in:
    - KSC-GP-792, Section 2.8, Timing Signal Formats [Complete]
    - IRIG-200-95, sections applicable to IRIG-B123, Inter-Range Timing Formats [Complete]
- The RTPS shall be capable of outputting CDT/MET at a 1 second rate to the facility timing interface in the format described in:
    - 80K56049, MILA Countdown Time Code Format [Complete]
- The RTPS shall be capable of outputting CDT/MET at a 1/10th second rate (10 times per second) to the facility timing interface in the format described in:
    - IRIG 215-96, IRIG Countdown Time Code Format [Complete]
- The RTPS shall provide the capability to set, start, stop, hold, and resume facility (ground) CDT/MET from selected operator positions. [Partial]
- The RTPS shall provide the capability to set, reset, start, stop, and hold the “time remaining” clocks in the OCR/MFR. [Partial]
- The RTPS shall provide the capability to synchronize Greenwich Mean Time (GMT) on board the Orbiter’s Master Timing Unit (MTU) to Universal Time Coordinated (UTC) with an accuracy of less than or equal to one millisecond. [Reference]
- All subsystems acquiring data from external GSE shall be synchronized to the Facility Timing UTC Interface to within 10 microseconds to support 100 microsecond measurement time-stamping. [Complete]
- All subsystems (except workstations and GSE Link Gateways) shall be synchronized to Range Time within TBD microseconds to support 1 millisecond time-stamping of measurements. [Complete]

Other System Requirements

- 4.5.2.2 The system shall provide a method to specify and cancel event notification and an event handler for the arrival of a specific GMT. [Complete]
- 4.5.2.3 The system shall provide a method to specify and cancel event notification and an event handler for the arrival of a specific CDT or MET. [Complete]
- 4.5.2.10 The system shall provide a method to activate or inhibit all timer event notifications active for the application. [Complete]
- 4.7.2.2 The system shall provide a method to set the systems CDT/MET. [Complete]
- 4.7.2.3 The system shall provide a method to determine if the GMT, CDT, or MET is using internal simulation of an external data source. [Complete] [Review]
- 4.7.2.5 The system shall provide a method for reading the system CDT/MET. [Complete]
- 4.7.2.6 The system shall provide a method to start and stop the system CDT/MET. [Complete]
- 4.7.2.7 The system shall provide a method to hold the system CDT/MET. [Complete]

- 4.7.2.1 The system shall provide a method to set the system GMT. [Complete]
- 4.7.2.4 The system shall provide a method for reading the systems GMT. [Complete]

8.1.5

Integrated Vehicle Health Monitoring System, Record Playback Subsystem, Hazardous Gas System, and other Consolidated Data Thread

Overview:

This thread provides process improvement to the current operations by providing visibility to the data from Integrated Vehicle Health Monitoring System, the Record Playback System, and Hazardous Gas System. These measurements will be consolidated in the Consolidated System Gateway and provided to the Shuttle Data Stream. This will make this data available in the current operational areas allow it to be used in the future by the CLCS system.

The Integrated Vehicle Health Monitoring Project is part of the Shuttle Upgrades program. Vehicle Health Monitoring Technology Demonstration, demonstrates two off-the-shelf sensing technologies in an operational environment to make informed design decisions for the proposed Orbiter upgrade. Vehicle Health Monitoring takes the Orbiter's instrumentation system a step further by providing capabilities to process data real-time versus merely recording data. The planned is to fly two Human Exploration and Development of Space Technology Demonstrations on the same Orbiter on successive flights with incorporation of additional sensors between flights. During cryogenic propellant load in terminal launch countdown, a Vehicle Health Monitoring data stream will be routed out of the Orbiter's T-0 umbilical for transmission, processing and viewing in the Launch Control Center. At approximately T-5 minutes, a command will be sent to the Vehicle Health Monitoring processor to begin recording data. Data will be recorded on ascent, during three planned one hour snap shot periods and on descent. The processor's memory will be dumped to a ground system after the Orbiter has landed and has rolled into its Orbiter Processing Facility bay.

The Backup hazardous Gas Detection System consists of a set of specialized hardware and software located in each of the mobile launchers. The system provides LPS HIM's with a very minimal set of data. The system is controlled (and more detail data is displayed) via a dumb terminal ;located in the CCMS control rooms. There is a project to upgrade this interface with a PC-based GUI (Labview) for command and control. This interface will provide a Shuttle Data Stream Prime to distribute this data to the user community.

The Record Playback System is use to record the downlink in analog format, and record and process FM data. In addition, it provide services process and view this data.

Additional data sources will be added to the Consolidated System Gateway and for recording on Shuttle Data Center.

Highlights:

- Additional data available in the operational control rooms
    - Integrated Vehicle Health Monitoring
    - Record Playback System
    - Hazardous Gas System

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

General

- Add commanding to the Consolidated System Gateway.

- Identify and implement command processing requirements. Add and document new Command packets as required.
- Identify and implement Metro health and status for display and maintenance interface
- Identify and implement GMS health and status for display and maintenance interface.
- Develop an Interface Control Document (ICD) between the Pad Meteorological System (or Consolidated Shuttle Data Stream Gateway ?) and CLCS.
- Develop an Interface Control Document (ICD) between the GMS (or Consolidated Shuttle Data Stream Gateway ?) and CLCS.
- Re-Validate the Shuttle Data Stream Prime data stream as required
- Oversee installation of Consolidated Systems Gateway Hardware in SDE-1, SDE-2, IDE-1 and LCC-X.

Integrated Vehicle Health Monitoring

- Identify and implement HTD-1 and HTD-2 health and status for display and maintenance interface
- Develop an Interface Control Document (ICD) between the HTD-1, HTD-2 and CLCS.
- Collect Integrated Vehicle Health Monitoring data for HTD2
- Consolidate Integrated Vehicle Health Monitoring data in the Consolidated System Gateway and merge output into Shuttle Data Stream Prime.
- Add Vehicle Health Monitoring to the Data Bank.
    - Define the HTD unique FDs and provide the system and application services to support them for the Vehicle Health Monitoring Technology Demonstration.
    - HTD2 has 300 FDs
- Support HTD1 and HTD2 testing

Record Playback Subsystem

- Review Record Playback Subsystem Statement of Work based on Thor work.
- Identify and implement Record Playback Subsystem health and status for display and maintenance interface.
- Develop an Interface Control Document (ICD) between the Record Playback Subsystem (or Consolidated Shuttle Data Stream Gateway ?) and CLCS.
- Collect data from the Record Playback Subsystem
- Provide selected Record Playback Subsystem data to the Consolidated System Gateway.
- Consolidate Integrated Record Playback System data in the Consolidated System Gateway and merge output into Shuttle Data Stream Prime.
- Define the Record Playback Subsystem unique FDs and provide the system and application services to support them.
- Add Record Playback Subsystem FDs to the Data Bank
- Build PCGOAL Display for Record Playback Subsystem
- Build sample CLCS Display for Record Playback Subsystem

Backup Hazardous Gas

- Identify and implement Hazardous Gas system health and status for display and maintenance interface.
- Develop an Interface Control Document (ICD) between the Hazardous Gas system(or Consolidated Shuttle Data Stream Gateway ?) and CLCS.
- Collect data from the Hazardous Gas system.
- Consolidate Integrated Backup Hazardous Gas data into the Consolidated System Gateway and merge output into Shuttle Data Stream Prime.
- Define the Hazardous Gas unique FDs and provide the system and application services to support them.
- Add Hazardous Gas FDs to the Data Bank
- Build PCGOAL Display for Hazardous Gas systems
- Build sample CLCS Display for Hazardous Gas systems

Requirements from SLS

- The CLCS interface to the Backup Hazardous Gas Detection System (HGDS) shall be via a buffered RS-232 interface. [Complete] [Review]
- 2.1.1.15.1 The Ground Measurement System (GMS) interface shall be via UDP/IP. [Done]
- 2.1.1.16.1 The Pad Meteorological System (Metro) interface shall be via a buffered RS-232 interface as described in:
    - KSC-DL-3768, LC-39 Pad Meteorological System LCC Computer System Theory of Operations [Done]

8.2

FOUNDATION SERVICE THREAD GROUP

- Commanding and Command Processor Phase 3 Thread
- System Data and Routing Thread
- Command and Control Workstation Phase 1 Thread
- System Control Phase 1 Thread
- Redundancy Management Phase 1 Thread
- Business And Support Information Services (BASIS) Phase 1.

8.2.1

Commanding and Command Processor Phase 3 Thread

Overview:

This thread supports commanding by cursor control, manual input, Test Application Scripts and End Item Managers. It also provides the command processor GUI and command structure for RTPS. This thread also provides Validation Test Cases for System Level Specification and Application Requirements.

Highlights:

- Continue support for cursor commanding.
- Build Command GUIs

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

Command Management

- Develop requirement table from SLS Appendix A listing the following:
    - Command has command line interface.
    - Command line interface is functional.
    - Command has application interface.
    - Application interface is functional
    - Command has GUI interface.
    - GUI Interface is functional.
    - Command has System Viewer Interface
    - System Viewer Interface is functional
    - Command Executes.
- Replace SLS Appendix A with requirement specification
- Develop a set of test procedures to test requirements as noted from the SLS and Applications.
- Complete commanding for
    - End Item Manager to Gateway
    - Command processor to Gateway
    - Command processor to End Item Managers
    - Command processor to Test Application Scripts
    - End Item Manager application to End Item Manager application commands.
- Provide all Launch Data Bus **FD** commands.
- Complete Launch Data Bus memory read write commands (GPC Memory Read, GPC Memory Write, Launch Data Bus Control)

- Provide support for commands needed for the Launch data Bus Interface Atlas Thread including application services.
    - Read and Load BITE status register
    - Perform BITE Test {1,2,3,4}
    - Perform Master Reset
    - Perform Test
- Provide prototype of $CMD function for CLCS
- Complete command authentication processing

Command Processor

- Provide specific support for command GUIs needed by Commanding Phase 3 Thread
- Implement a complete set of GUIs to provide command functions needed in RTPS

Requirements From SLS

- 2.2.1.1.3 The CLCS shall be designed to have a high level of data integrity. Specifically the system shall provide the following: [Partial]
- No loss of command data within the CLCS [Partial]
- 2.2.2.1.4 The system shall provide the capability for a single test (control) application to queue multiple LDB commands to support every LDB command opportunity. [Complete]
- 2.2.2.1.8 GSE command/response latency of a priority command, or of a non-priority command in an unloaded system, shall be less than 20 milliseconds from the time a test/control application issues the command until the response is received by the test application. [Complete]
- 2.2.2.1.14 The system shall support executing a manual command in less than one second from human execution to RTPS interface output. [Complete]
- 2.2.2.2.2 RTPS shall be able to support full Uplink command rates on the following links: [Complete]
    - LDB - 8/second [Complete]
    - PCM Uplink - 50/second (Titan) [Reference]
    - GSE - 500/second. [Complete]
- 2.2.2.2.3 All PCM Downlink and GSE gateways shall be able to support 10 table maintenance changes per second, with all measurement values changing every sample with no checkpointing active, per Table 2.2. [Complete]
- 2.2.3.2.1 The CLCS shall process all data types processed by the CCMS except MODCOMP Floating Point Data Types. (See Appendix A) [Complete]
- 2.2.3.2.2 The CLCS shall process the following additional data types.

Measurement Types	Command Types
12 bit GSE Analogs	12 bit GSE Analogs
16 bit GSE Analogs	16 bit GSE Analogs
Multi-word digital patterns	Multi-word digital patterns
Strings	Strings
IEEE 754 floating point	IEEE 754 floating point
State (Enumerated)	State (Enumerated)

- 2.2.5.5.1 RTPS shall provide the capability to verify that certain conditions are met before issuing any FD command to an End-Item. [Complete]

- 2.2.5.5.3 RTPS shall provide the capability to override Prerequisite Control Logic prior to and after a command has been blocked. [Complete]
- 2.2.5.5.4 RTPS shall provide the capability for Reactive Sequence Test applications to bypass Prerequisite Control Logic. [Complete]
- 2.2.5.8.8 The RTPS User Display function shall provide the capability to issue cursor control commands to End-Item Managers. [Complete]

Other System Requirements

- 4.1.4 The system shall provide a method to specify a time value for a discrete command. This command shall set the command to the indicated state for the specified period and then return it to the original state. [Complete]
- 4.1.5. The system shall provide a global constant (method of) indicating why a command has failed. This status shall indicate the following error conditions: [Complete]
    - 4.1.5.1 Command blocked by a prerequisite sequence [Complete]
    - 4.1.5.2 Command blocked by authentication [Complete]
    - 4.1.5.3 Command parameter mismatch [Complete]
    - 4.1.5.4 Time out [Complete]
- 4.2.1.1 The system shall provide a method to issue values to analog output FD's. [Complete]
- 4.2.1.3 The system shall issue discrete output FD's using the literal key words OPEN, CLOSE, TRUE, FALSE, WET, DRY, ON, OFF. [Complete]
- 4.2.1.4 The system shall provide a method to specify a time value for a discrete command. This command shall set the command to the indicated state for the specified period and then return it to the original state. [Complete]
- 4.2.1.6 The system shall provide a method for issuing a value to digital pattern output FD's. [Complete]
- 4.2.1.7 The system shall support one-to-one and one-to-many options for the issuance of values to FD's [Complete]
- 4.2.1.8 The system shall validate that issued values are compatible with Function Designator types prior to issuing the command. [Complete]
- 4.2.4.1.1 The system shall provide a method for changing the constraint limits associated with an analog FD. [Complete]
- 4.2.4.3.2 The system shall provide a method for changing the significant change value of an analog FD. [Review]
- 4.2.4.3.3 The system shall provide a method for changing the stale data count for any FD. [Review]
- 4.2.4.3.4 The system shall provide a method for changing calibration coefficients. [Complete]
- 4.2.4.3.7 The system shall provide a method to activate or inhibit stale data checking on a per FD basis. [Review]
- 4.2.4.3.9 The system shall provide a method for reading the current significant change value for an analog FD. [Review]
- 4.2.4.3.10 The system shall provide a method to read the current stale data count for any FD. [Review]
- 4.3.1.4 The system shall provide a method to activate or inhibit stale data checking on any gateway. [Review]

8.2.2

System Data and Routing Thread

Overview:

This thread completes the efforts to provide data to the RTPS, provide for system logical routing and Validation Test Cases for System Level Specification and Application Requirements.

The Atlas Reliable Message Thread work will consist of a major enhancement to the Network Services CSC. An addition to the Network Services system and underlying implementation will be developed, replacing the Reliable Multicast functionality from previous releases. Other existing AM/CLM functionality from previous releases will remain unchanged.

Highlights:

- Add dynamic routing to data flow
- Performance tune Reliable Message Services
- Performance tune Data Distribution Services
- Finalize Data Fusion Creation Editor

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- The stream naming and address mapping convention of previous releases will be abandoned. In Atlas, messages will be sent to Logical Destinations, which in most cases will map to a logical host within the test set. Hosts other than the host assigned to the Logical Destination will be able to monitor messages sent to that destination and participate in reliable messaging. The capability will be provided to create Logical Destinations with no host association, when appropriate (e.g.: Data Distribution, System Messages). Within a given test set or activity, Logical Destinations will map one-to-one with multicast addresses.
- Activity Separation will be supported based on a numerical activity ID. Each activity ID will map to a private range of multicast addresses for that activity.
- A server process will be implemented to handle the real-time exchange of data and acknowledgments on behalf of client applications.
- Both periodic and non-periodic message streams will be supported with efficient protocols for each stream type.
- As a design goal, the number of in-memory copy operations during normal message processing will be minimized.
- Updates of errors and events will be provided for use by Subsystem Integrity.
- Adequate information will be provided to O&M for notification and troubleshooting of Reliable Messages events and errors.

- Performance budgets for Reliable Messages based on these SLS requirements will be generated in coordination with SE&I.
- Add support for transport of CORBA transaction by Reliable Messages.
- Design and provide a dynamic RTPS routing system
    - Allows reference to a communication destination by application name.
    - Allows reference to a communication destination by FD name.
    - Allows reference to a communication destination by subsystem node name.
    - Permits routing to be changed in real-time.
- Update and improve data Fusion Editor.
- Update system performance modeling data to accurately track real system.
- Add support for Block Log to the recording system.
- Add support for Block Log to an application.

Provide the following support for enumerated type FDs:

- The primary method of command and reading an enumeration FD shall be by enumeration value in a type safe manner. However, conversion must be provided for exception cases to numeric values.
- Provide for enumerated types Basic & Tailored Application Services read/command support.
    - Provide Tailored support for EIMs, S/L displays, PCL, Data Fusion, and TAS.
    - Provide support to read an enumeration FD into a type safe enumeration variable.
    - Provide support to command an enumeration FD from an enumerated value.
    - Provide Data Fusion generate enumerated type data fusion FDs.
    - Command Processor read/command
    - Provide FD Viewer read support.
- Data Retrieval applications shall support retrieval of enumerated FD values by enumeration and by underlying numeric value.(Titan)
- Provide the capability to predefine classes of enumerated FDs so that the set of enumeration states is consistent across the class and can be updated in a single place.

Requirements from SLS

- 2.2.1.1.2 The RTPS shall be fault tolerant. Specifically, the system shall provide the capability to recover from subsystem failures in the following areas:
    - Data Distribution Processing (Titan) [Reference]
    - Real Time Critical Network and the Display and Control Network [Partial]
- 2.2.1.1.3 The CLCS shall be designed to have a high level of data integrity. Specifically the system shall provide the following:
    - No loss of command data within the CLCS [Partial]
    - No loss of measurement data within the CLCS [Partial]
    - No loss of measurement samples to applications requesting such service [Partial]
    - No data which has been corrupted within the CLCS [Partial]
    - Health data on a measurement basis [Partial]
- 2.2.1.1.5 The loss of any RTPS Real Time Network component shall not cause switchover of more than one standby subsystem. [Partial]

- 2.2.2.1.1 The system shall support 25, 000 End-Item Function Designator changes per second continuously. This is the “system maximum data bandwidth”. [Complete]
- 2.2.2.1.2 The system shall support a peak of 50, 000 End-Item Function Designator changes in a given second without losing any data. [Complete]
- 2.2.2.1.4 The system shall support 1, 000 End-Item Function Designator changes during a 10 millisecond period. [Complete]
- 2.2.2.1.11 Ten user test applications shall each be able to read 1, 000 measurements per second, comparing each measurement with an expected state, in a single subsystem supporting the “system maximum data bandwidth”. [Complete]
- 2.2.2.1.15 The Data Health Function shall support the “system maximum data bandwidth”. [Complete]
- 2.2.2.1.16 The Data Fusion function shall support the “system maximum data bandwidth” with one fusion calculation per End-Item Function Designator change. [Complete]
- 2.2.2.1.19 The data distribution function shall support the “system maximum data bandwidth”, plus 5, 000 (20%) Data Fusion updates per second. [Complete]
- 2.2.3.1.3 The RTPS shall maintain the current value of all Measurement FD for access by application SW. [Done]
- 2.2.3.1.4 The RTPS shall provide the capability for applications to request all changes of a selected set of Measurement FDs and have them provided along with time of change and health at the time of change. [Complete]
- 2.2.3.1.5 The RTPS shall provide changed measurement data to system and user applications at the System Synchronous Rate. [Complete]
- 2.2.3.1.6 The RTPS shall provide changed measurement data to display applications at the Display Synchronous Rate. [Complete]
- 2.2.3.1.7 The RTPS shall provide the capability to refresh measurement and command data when needed. [Complete]
- 2.2.3.2.1 The CLCS shall process all data types processed by the CCMS except MODCOMP Floating Point Data Types. (See Appendix A) [Complete]
- 2.2.3.2.2 The CLCS shall process the following additional data types.

Measurement Types	Command Types
12 bit GSE Analogs	12 bit GSE Analogs
16 bit GSE Analogs	16 bit GSE Analogs
Multi-word digital patterns	Multi-word digital patterns
Strings	Strings
IEEE 754 floating point	IEEE 754 floating point
State (Enumerated)	State (Enumerated)

- **System Messages**
- 2.2.4.2.1 The CLCS shall provide a central repository for System Messages and their associated definitions. [Complete]
- 2.2.4.2.2 The RTPS shall allow users to register for and receive System Messages for a requested Message Group and Severity. [Complete]
- 2.2.4.2.3 Every System Message shall provide information regarding why the System Message is being generated and shall include, but not be limited to, the time and date of the System Message, and the origin of the System Message. [Complete]

- 2.2.4.2.4 The RTPS shall provide the capability to associate additional data with any System Message (e.g., Help and status information of a set of resources). [Complete]
- 2.2.5.1.7 CLCS shall provide the user the capability to create Pseudo FDs and generate their values using Test Applications. [Complete]
- 2.2.5.1.8 CLCS shall provide a set of System Status Function Designators which depict the status of subsystems within an RTPS. [Complete]
- 2.2.5.1.11 CLCS shall support a set of System Function Designators which depict information about the RTPS and the test in progress (e.g., GMT, Date, CDT, GW, TCID Name). [Complete]
- **Data Health.**
- 2.2.5.2.1 The RTPS shall automatically track and maintain the health of all Measurement FDs. [Complete]
- 2.2.5.2.2 Data health information shall be updated any time the health changes. [Complete]
- 2.2.5.2.3 The RTPS shall provide health information to all users and system or user applications of measurement information. [Complete]
- 2.2.5.2.4 Users and system and user applications shall have the capability to view health and status information on individual and groups of measurements. [Complete]
- 2.2.5.2.5 The RTPS shall provide the capability to set and reset health and status. [Complete]
- 2.2.5.2.6 RTPS Measurement FD Health shall include the known information about processing within CLCS including Gateway FD processing and redundancy management. [Complete]
- 2.2.5.2.7 RTPS Measurement FD Health shall include the capability for manual input by engineering personnel. [Complete]
- **Data Fusion**
- 2.2.5.3.1 CLCS shall provide the capability to define, view, and execute the algorithms for performing data fusion. [Complete]
- 2.2.5.3.2 A Fused Data Function Designator shall be recalculated whenever any of its input parameters change. [Complete]
- 2.2.5.3.3 When the value of a Fused FD changes the new value shall be transmitted to all users, and system or user applications at the System and Display Synchronous Rates. [Complete]
- 2.2.5.3.4 The Data Fusion function shall allow activation and deactivation of Fused Data Function Designator Processing. [Complete]
- 2.2.5.3.5 The Data Fusion function shall provide the capability to set the value of a Fused FD. [Complete]
- 2.2.5.3.7 The RTPS Measurement FD Fusion function shall provide up to 5 levels of Data Fusion nesting. [Complete]
- 2.2.5.3.8 RTPS shall provide the capability to automatically maintain the values of Data Fusion FDs. [Complete]
- **User Display**
- 2.2.5.8.1 The CLCS shall provide the capability to monitor all measurement data available to the test set. [Complete]
- 2.2.5.8.2 The CLCS shall provide the capability to display the current value of a measurement and all data related to the measurement. [Complete]

- 2.2.5.8.3 The CLCS shall provide the capability to plot data from both real time acquisition of the data and data retrieved from the recording media to the Command and Control Workstation CRT. [Partial]

Other System Requirements

- 4.1.1 The system shall preserve the current LPS engineering unit model. The system shall be able to work with temperatures, pressures, discrete states, and enumerated states. [Complete]
- 4.2.1.9 The system shall provide a method for issuing values to a pseudo function designator. [Complete]
- 4.2.2.2 The system shall provide a method for reading the current value of an analog FD in raw counts. [Complete]
- 4.2.2.3 The system shall provide a method for reading the current value of a digital pattern FD and enumerated type FD. [Complete]
- 4.2.2.4 The system shall provide a method for reading the current value of a discrete FD in engineering units. [Complete]
- 4.2.2.5 The system shall provide a method for reading the current value of a discrete FD in unprocessed format. [Complete]
- 4.2.2.8 The system shall provide a method for converting a raw data word into measurement data. (Reference KSC-LPS-OP-033-04 Section 2.1) [Complete]
- 4.2.3.1 The system shall provide a method to identify function designators that shall be delivered via queued service, providing access to every change value in time ordered fashion [Complete]
- 4.2.3.2 The system shall provide a method to read the next value of a multi-sample queued function designators. [Complete]
- 4.2.3.3 The system shall provide a method to read the next N values of a multi-sample queued function designator. [Complete]
- 4.2.3.4 The system shall provide a method to clear all queued samples pending for the application. [Complete]
- 4.2.3.5 The system shall provide a method to cancel queued function designator delivery by FD. [Complete]
- 4.2.4.2.1 The system shall provide a method to activate, inhibit, or status any data fusion processing on a per FD basis. [Complete]
- 4.2.4.2.2 The system shall provide a method for reading all fusion logic associated with an FD. [Complete]
- 4.2.4.2.3 The system shall provide a method for retrieving a list of all FD's associated with a data fusion FD. [Complete]
- 4.3.2.4 The system shall provide a method to read the stale data check processing status of any gateway. [Review]
- 4.2.4.3.6 The system shall provide a method to activate or inhibit measurement processing on a per FD basis. [Complete]
- 4.2.4.3.11 The system shall provide the capability to read the current hardware address of an FD. [Complete]
- 4.2.4.4.1 The system shall provide a method for determining if a function designators health status is OK, FAILED, or WARNING. [Complete]

- 4.2.4.4.2 The system shall provide a method of reading the detailed health status from the health status word for a function designator. The detailed health shall identify the following conditions: [Complete]
    - 4.2.4.4.2.1 Was the last value change or refresh data? [Review]
    - 4.2.4.4.2.2 Is processing active or inhibited for this FD? [Complete]
    - 4.2.4.4.2.3 Is gateway group processing active or inhibited for this FD? [Complete]
    - 4.2.4.4.2.4 Is Engineering active or inhibited for this FD? [Complete]
    - 4.2.4.4.2.5 Is the data path associated with this FD active or inhibited? [Complete]
    - 4.2.4.4.2.6 Is application advisory notification active or inhibited for this FD? [Review]
    - 4.2.4.4.2.7 Is engineering bypass active or inhibited for this FD? [Complete]
- 4.2.4.4.3 The system shall provide a method for reading the current data stale indicator for an FD. [Review]
- 4.2.4.4.4 The system shall provide a method to change an FD's status indicator (event) in order to mark the measurement bad or good. [Complete]
- 4.2.5.1 The system shall provide a method for querying the on-line data bank by FDID or FD name. [Complete]
- 4.2.5.2 The system shall provide a method for querying any piece of information stored in the on-line data bank for a particular FD. [Complete]
- 4.2.8.3 The system shall provide the text field associated with a system message. [Complete]
- 4.3.1.7 The system shall provide a method to activate or inhibit data fusion processing at any Data Distribution Processor. [Complete]
- 4.3.2.1 The system shall provide a method to read the current health status of any subsystem within the CLCS. [Complete]
- 4.5.1.4 The system shall provide methods for communicating between concurrently executing applications as described in 4.5.1.3 above. [Complete]
- 4.8.1.1 The system shall provide a method to record a system message for distribution and display. [Complete]
- 4.8.1.2 The system shall provide a method for retrieving system message text from the system message data base based on a predefined system message number. [Complete]
- 4.8.1.3 The system shall provide a method for specifying a system message group, message number, severity indicator, and message inserts. [Complete]
- 4.8.2.2 The system shall provide a method for recording a time tagged message to any or all of the available output devices including the local printer, archival function, etc. [Complete]
- 4.8.2.3 The system shall provide text field associated with a health reason code. [Complete]
- The system shall provide a method for reading the return to limits indicator (event) of digital pattern / Enumerated FD. [Complete]

8.2.3

Command and Control Workstation Phase 1 Thread

Overview:

This thread provides for the integration of and upgrades to the Command and Control Workstation to support the total user environment. It includes work on viewers, Dynamic Display Tools, User Environment Management, and Operation of this platform.

Highlights:

- Develop Programmable Function Panel
- Complete System Viewers
-

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Update Thor viewers based on user feedback.
- Complete System Message Viewer
    - Provide System Message Viewer Retrieval prototype.
    - Ensure System Message Viewer Retrieval has similar “look and feel” of Web-based retrievals.
- Provide the capability to run, start, and shutdown applications.
- Provide the capability for the Viewer function to be utilized in both Operational and Desktop Debug configurations.
- Develop DNAV replacement (Task Bar Viewer- Control Navigation System).
- Provide software Programmable function Key replacement.
- Provide interface to allow application to setup Constraint and Display Monitor.
- Provide plot capability for real-time and recorded data.
- Develop Subsystem Engineering Package for this subsystem.

Requirements from SLS

- The Display function shall, for a single workstation, support updating of 250 displayed FDs out of 500 in one second in a single window. [Complete]
- The Display function shall, for a single workstation, support updating 50% of the FD’s every second on 13 windows with 100 FD’s in each window. [Complete]

- The system shall, for a single workstation, display a new graphical screen with up to 500 FDs in 250 milliseconds when the screen (active but not displayed) is selected for viewing. [Complete]
- The RTPS shall provide a set of System Viewers which provide selected data for display without requiring the user to develop a specific display. [Complete]
- The RTPS shall provide a FD Viewer which provides a mechanism for viewing all available information about any RTPS FD. [Complete]
- The FD Viewer shall be linkable to user and system displays. [Complete]
- The FD Viewer shall provide a mechanism for viewing all available information about any measurement FD's Health. [Complete]
- The Display Monitor Viewer shall periodically update the displayed Measurement FD information. [Complete]
- The FD Viewer shall provide a mechanism for viewing all available information about a Fused FD. [Complete]
- The FD Viewer shall provide a mechanism for viewing information about constraints asserted against a specific measurement FD. [Complete]
- The FD Viewer shall update the information displayed when the window is selected by the user. [Complete]
- The RTPS shall provide a Constraint Monitor Viewer which provides a mechanism for asserting and viewing constraints against measurement FDs for Constraint Monitor purposes only. [Complete]
- The RTPS shall provide a Display Monitor Viewer which provides a mechanism for asserting and viewing information for selected measurement FDs for Display Monitor purposes only. [Complete]
- The RTPS shall provide the capability for user test applications to setup the Constraint Monitor and Display Monitor Viewers' FDs. [Complete]
- The CLCS shall provide the off-line capability to create a User Display which is independent of any user test application. [Complete]
- The CLCS shall provide the capability to display the current value of a measurement and all data related to the measurement. [Complete]
- The CLCS shall provide the capability to plot data from both real time acquisition of the data and data retrieved from the recording media to the Command and Control Workstation CRT. [Complete]
- CLCS shall provide the capability for users to define display applications that provide user manual End-Item control and visibility. [Complete]
- The RTPS User Display function shall provide the capability to read and display information derived from FDs. [Complete]
- The RTPS User Display function shall provide the capability to issue commands to FDs by cursor control regardless of whether there is a End-Item Manager controlling the FDs or not. [Complete]
- The RTPS User Display function shall provide the capability to issue cursor control commands to End-Item Managers. [Complete]
- The RTPS User Display function shall provide the capability to initiate other displays. [Complete]

Other System Requirements

- 4.4.1.1 The system shall provide a method for opening a display window at the workstation [Complete]
- 4.4.1.3 The system shall provide the capability to close a window at the workstation. [Complete]
- 4.4.1.5 The system shall provide a method to issue a prompt to, and receive response from, a user display window. [Complete]
- 4.5.2.9 The system shall provide a method to activate or inhibit display object notification active for the application. [Complete]
- 4.4.1.8 The system shall provide a method for writing text labels to the programmable front panel (PFP) or equivalent interface. [Complete]
- 4.4.1.6 The system shall provide a means for writing text strings to text objects in a user display window. [Complete]

8.2.4

System Control Phase 1 Thread

Overview:

This thread provide the infrastructure needed to manage, control, assign, allocate, and monitor the RTPS. See section 11.3 for allocation of control function to threads. For the purpose of this delivery we will focus on the initial processes and view that will be integrated with Master Console Control Navigation System environment in the next delivery. This environment provides access to a set of tools to monitor and change the system configuration as well as general use tools (Constraint Viewer FD Viewer,). A set of manager tools and viewers are required to coordinate activities across the set in 4 areas Resource Management, Operation Configuration Management, Test Progress Monitoring, and Maintenance Management are applications at this level. A set of processes and viewers are needed to provide to coordinate SCID Load, TCID Load, Network monitoring, Performance Monitoring, and Operational Readiness Test. These agents implement data collection and implement operational action in a set.. Subsystem software is needed to perform required activities.

This thread also provides the initial software to manage the resources within a test set and to manage the assignment of resources in a configurable set. Resource management is an activity that is typically accomplished in configurable RTPS Sets (e.g., the LCC Set). The Set Master in the Central Operation Facility performs the initial allocation of resources and initiates loading of software from the Set Master equipment in the Common Equipment Area (CEA). Once Test Sets are established within a configurable RTPS Set, Resource Management then transfers control of the Test Set to the Test Set Master in the Test Set area. In non-configurable RTPS Sets, many of the functions of Resource Management are not applicable since hardware is not available to establish and subsequently control Test Sets.

Highlights:

- Capability to manage a RTPS set.

Statement Of Work

General

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Review CSCI and CSC allocation
- Provide the top level design for System Control

Test Progress Monitoring

- Monitor the operational state of all subsystem and links
- Monitor the state of platform system software loads
- Monitor the state of platform application loads
- Monitor the State of system software.
- Monitor the State of application software.

- Monitor the flow of Test Sequences and OMIs
- Provide access to processor and network status information.
- Provide an initial Performance/Capacity Monitor System Viewer to support online visibility and tracking of system measured performance against system capacity limitations

Operation Configuration Management

- Provide capability to control and track a subsystem by:
  - Group Assignment (control group, gateway group, Workstation Networks)
  - Activity Assignment (TCID, Function)
  - Role Assignment (Active, Standby, Backup)
  - Function Assignment (application group, link name, Data Distribution Processor/Command and Control Processor)
  - Load State (OS, SCID, TCID, Checkpoint tables))
  - Activation State (Loading, ORT, Communicating, Processing)
- Permit activation of the load function for a given subsystem
- Provide the capability to configure network subsystems
- Provide the capability to configure gateway front end switching.
- Perform design review of Link Switch and link patching.

Resource Management

- Log changes to resource assignment
- Retain resource assignments to permit reconfiguration.
- Represent Resource requirements in both logical and physical configurations
- Allow a physical configuration to be converted to a logical configuration for reassignment of different subsystems.
- Provide an auto configuration process to assign default physical subsystems to a logical configuration.

Maintenance Management

- Develop design for infrastructure for system and subsystem level Operational Readiness Tests.

Requirements from SLS

- The RTPS shall provide automated load capabilities for platform, subsystem, and test loads. [Partial]
- The RTPS shall provide the capability to make real-time configuration updates/modifications portions of SCIDs and TCIDs without requiring a complete reload of the SCID or TCID. [Partial]
- The RTPS shall provide the capability to verify the integrity of loaded software (i.e., presence, revision and CRC of required modules). [Partial]
- The RTPS shall provide the capability to verify the integrity of software loaded in a Test Set environment at any time without impact to real-time operations. [Partial]
- The RTPS shall provide the capability to manage all equipment in an RTPS set. [Partial]
- The CLCS shall provide the capability, in each configurable RTPS set, to control/configure all of the equipment in the set that may be allocated to multiple parallel Test Sets. [Partial]

- The CLCS shall provide the capability to define a Test Set Activity which contains a list of the HW (e.g., network resources, subsystems, end item connectivity, etc.), and SW resources (e.g., SCID, TCID, etc.) needed to perform the activity. [Reference]
- Test Set Activities shall be capable of being pre-defined, stored for later use, and modified during use. [Partial]
- The RTPS shall provide a set of visual displays that provide comprehensive insight into the state and configuration of the set resources (e.g., network resources, subsystem assignments, software configuration, etc.). [Partial]
- The RTPS shall provide different views of test sets and activities in configurable sets (e.g., Master Set View, Test Set View, Activity View). [Partial]

Setup and Allocation of Resources

- The RTPS shall provide physical and electronic devices to permit configuration of end item links to the RTPS gateways. [Partial]
- The RTPS shall provide the capability to configure subsystem hardware to support a defined Test Set Activity physically and logically isolated from other Test Set Activities. [Partial]
- The RTPS shall provide the capability to assign network resources to processors within Gateway Groups, Control Groups, and Flow Zones (FZs). [Partial]
- The CLCS shall provide SW to assist in the configuration of the RTPS Test Set Hardware. [Partial]
- The RTPS shall provide a method to associate Gateway Groups with one or more Control Groups. [Complete]
- The RTPS shall provide a method to associate one or more Control Groups with a set of Workstation Positions to create a flow zone. [Complete]
- The RTPS shall provide the capability to configure users' workstations for selected activities [Complete]
- The RTPS shall provide the capability to monitor the current status of the assignment of network and processor resources. [Complete]
- The CLCS shall provide effective support to test director and test management personnel to efficiently and reliably control and track testing progress. [Reference]
- A loaded and initialized Launch Configuration Test Set shall take less than 5 minutes to be activated. [Reference]
- The time required to reconfigure a Launch Configuration Test Set to a new Test shall not exceed 15 minutes, assuming the new Test was previously loaded. [Reference]
- The time required to reconfigure a failed Subsystem to an operational state, including configuration verification, shall not exceed 15 minutes assuming all software is already loaded on local disk. [Partial]

Other System requirements

- 4.5.1.1 The system shall provide a method to initialize an application and register its existence with the system. [Complete]
- 4.5.1.2 The system shall provide a method to terminate an application and release all system resources associated with the application. [Complete]
- 4.5.1.5 The system shall provide a method for allowing a user application to enter and exit a higher priority state. [Complete]

8.2.5

Redundancy Management Phase 1 Thread

Overview:

This thread provides the base for constructing a fault tolerant RTPS. See section 11.3 for allocation of control function to threads. It provides for the detection of subsystem failures, monitoring of active counterparts, and the execution of fail-safe or failover functions.

This thread provides the supporting System and Subsystem Integrity infrastructure. It supports the operation of the System Configuration. It provides for the initialization tracking and termination of system and application software. These functions will be used by System Load and Test Load, Test Activation, Resource Management, and Test Control Progress Monitoring. It uses functions from Subsystem Check Point Restart and Subsystem Redundancy Management.

Highlights:

- Provide subsystem health.
- Provide Subsystem Initialization
- Report Process Health
- Provide failover for GSE, LDB, and PCM gateway

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

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    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

General

- From Real-Time Critical Network based subsystems, provide Subsystem Integrity information to System Integrity at the System Synchronous Rate.
- Report Required Subsystem integrity data to System integrity.
- Provide collection and detection of system failures.
- Provide notification of failures.
    - System Messages
    - Event Notification to register applications
    - System status FDs
- Provide Management from System Integrity to maintain system status.
    - Update FD status on System unavailability.
    - Update Subsystem Status based on state.
- Provide coordination of subsystem redundancy switchover.
    - Enable and disable Subsystem as active

- Enable and disable subsystem as standby.
- Enable and disable subsystem for failover.
- Direct subsystem to failover.

- Provide coordination of
- Update requirement Matrix in SLS

GSE Gateway

- Provide detection and reporting of:
  - Loss of Ground Data Bus
  - Loss of Hardware Interface Module
  - Loss of Hardware Interface Module Card
  - Detectable Subsystem Failures.
  - Failure of Active/Standby pair.
- Execute the following actions:
  - Switch ground Data Busses
  - Re-initialize Hardware Interface Module input scans.
  - Re-initialize Hardware Interface Module output states.
  - Completing incomplete Command transactions.
  - Switch Real-Time Critical Network Networks

LDB Gateway

- Provide detection and reporting of:
  - Loss of Launch Data Bus
  - Detectable Subsystem Failures.
  - Failure of Active/Standby pair.
- Execute the following actions:
  - Switch Launch Data Bus
  - Complete incomplete Command transactions (TITAN)
  - Synchronizing transactions between Active/Standby pair (TITAN)
  - Switch Real-Time Critical Network Networks

OFI PCM and SSME Gateway

- Provide detection and reporting of:
  - Loss of Down Link Signal (Signal Level Bit Sync, Frame Sync)
  - Detectable Subsystem Failures.
  - Failure of Active/Standby pair.
- Execute the following actions:
  - Switch Down link inputs
  - Switch Real-Time Critical Network Networks

Data Distribution Processing

- Provide capability to perform true redundant processing
- Provide detection and reporting of:
  - Loss of packet data from source provider
  - Detectable Subsystem Failures.
  - Failure of Active/Standby pair.

- Execute the following actions:
    - Source data selection
    - Data invalidation on provider failure.
    - Re initialize on failover of Data Processing
    - Synchronizing of data table between Active/Standby pair
    - Switch Real-Time Critical Network Networks

Command and Control Processing

- Provide detection and reporting of:
    - Loss of packet data from source provider
    - Detectable Subsystem Failures.
    - Failure of Application Software
- Provide detection and reporting of:
    - Provide method to direct Applications or Application sets to a safe state.
    - Provide method to direct Applications or Application sets to stop processing
    - Provide method to direct Applications or Application sets to start processing
    - Provide method to direct Applications or Application sets to a switch over state processing
    - Switch Real-Time Critical Network Networks

Command and Control Workstation

- Provide detection and reporting of:
    - Lose of packet data from source provider
    - Detectable Subsystem Failures.
    - Failure of Display Software
- Execute the following actions:
    - Provide method to direct Applications or Application sets to stop processing
    - Provide method to direct Applications or Application sets to start processing

Real-Time Critical Network

- Provide as part of reliable messages a fault tolerant network.

Requirements from SLS

- The RTPS shall provide the capability to load and initialize the following Software in each subsystem of the Test Set:
    - Platform load [Complete]
    - Subsystem Load (SCID) [Complete]
    - Test SW Load (TCID) [Complete]
- The RTPS shall provide the O&M operator with the capability to select, load, monitor load progress, verify the load, and initialize all Software required in the [Complete]
- The RTPS shall provide a central point to coordinate and direct redundant element activation (known as System Integrity). [Complete]
- System Integrity shall be capable of being run from any Console Position within a Test Set. [Complete]
- The RTPS shall provide the capability for a Standby copy of System Integrity to run and monitor the activities of the Active copy of System Integrity. (Titan) [Reference]

- When the Standby copy of System Integrity determines that the Active copy is not operating properly it shall assume the role and responsibilities of the Active System Integrity. (Titan) [Reference]
- The RTPS shall provide a method to share current configuration data with a redundant element. [Reference]
- The RTPS shall provide a method to track redundant element states. [Reference]
- System Integrity shall monitor critical subsystems for failure and in the event a monitored subsystem fails, shall perform a switchover (if enabled) to the standby subsystem. [Partial]
- System Integrity shall report all subsystem errors to a central point. [Complete]
- The CLCS shall provide a reduced capability mode in which a Test Set continues to support even though all copies of System Integrity fail. (Titan) [Partial]
- GSE and PCM Gateways, configured as a redundant pair, shall switch to the standby Gateway with no loss of measurement data and within 1 System Synchronous Rate Time Period of detection. [Complete] [Review]
- For Gateways (except LDB) configured as a redundant pair, switch-over for commands shall be completed in less than 20 milliseconds without any loss of commands. [Partial]
- LDB Gateway switch-over shall be accomplished without any loss of data or commands and shall be completed in less than 500 milliseconds. [Partial]
- The RTPS shall be designed to be Fail Safe. [Partial]
- The RTPS shall be fault tolerant. Specifically, the system shall provide the capability to recover from subsystem failures in the following areas:
    - Command and Control Processing [Partial]
    - Data Distribution Processing [Partial]
    - Critical Data Acquisition Gateways (i.e., LDB, 128 & 192 Kb PCM, GSE) [Partial]
    - Real Time Critical Network and the Display and Control Network [Complete]
- The CLCS shall be designed to have a high level of data integrity. Specifically the system shall provide the following:
    - No loss of command data within the CLCS [Partial]
    - No loss of measurement data within the CLCS [Partial]
    - No loss of measurement samples to applications requesting such service [Partial]
    - No data which has been corrupted within the CLCS [Partial]
    - Health data on a measurement basis [Partial]
- The RTPS shall provide fault tolerance in the Command and Control HCI positions. [Complete]
- The loss of any RTPS Real Time Network component shall not cause switchover of more than one standby subsystem [Complete]

Other System Requirements

- 4.3.1.6 The system shall provide a method to activate or inhibit active/standby switch over for any redundant subsystem. [Complete]
- 4.3.2.3 The system shall provide a method to read the commanding status of any subsystem. [Complete]
- 4.3.2.6 The system shall provide a method for reading the summary error indicators and counts from any subsystem. [Complete]

8.2.6

Subsystem Checkpoint Restart Thread

Overview:

This thread provides the capability to save the state of various tables to reflect their state as a result of real-time table updates. It also provides the capability to restore the system to a previously saved state. See section 11.3 for allocation of control function to threads.

Highlights:

- Provide checkpoint restart capability for the RTPS

Statement Of Work

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    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Provide Checkpoint Functions
    - Save current table images
    - Enable/Disable transaction recording
    - Restore saved table image
    - Applied Transaction updates
    - Store table images to Shuttle Data Center.
    - Retrieve table images from Shuttle Data Center.
    - Update Current Value Table
    - Synchronize to master tables
    - Display checkpoint table images
    - Edit checkpoint table images
- Provide the capability to record table updates against saved baseline images in real-time
- Provide the capability to apply transaction updates after loading baseline images
- Provide the capability to save local images to the Shuttle Data Center
- Provide the capability to load images from the Shuttle Data Center
- Provide GUI to perform Checkpoint Functions
- Provide APIs to perform Checkpoint Function
- Provide capability to provide a formatted display of all Checkpoint Tables
- Provide capability to edit select fields in Checkpoint Tables

- Develop design for Persistent Data

Gateways All

- Provide the capability to save individually, by name, images to local disk of the:
  - Polling Tables
  - Format Tables.
  - Measurement Description
  - Calibration coefficients
- Provide the capability to load an image individually, by name, from local disk of the:
  - Polling Table
  - Format Tables
  - Measurement Description
  - Calibration Coefficients

Gateways Ground Support Equipment

- Provide the capability to scan all HIM outputs to update command output status table.
- Provide the capability to scan all HIM outputs to confirm that they are the same as current commanded state.
- Provide the capability to scan all polling table HIM inputs to update current value tables.
- Provide the capability to output, on demand to the Real-Time Critical Network all polling table HIM inputs values.

Gateways PCM

- Provide the capability to output, on demand to the Real-Time Critical Network, values of all FDs in the current format.

Data Distribution Processor

- Provide the capability to save individually by name images to local disk of the:
  - On-Line Databank
  - Current Value Table (no real-time update)
  - Constraint Tables
  - Authentication Table
- Provide the capability to load an image individually by name from local disk of the:
  - On-Line Databank
  - Current Value Table
  - Constraint Tables
  - Authentication Table
- Provide the capability to output one time on the Real-Time Critical Network and Display and Command Network values of all derived FDs.
- Provide the capability to derive current value table from Shuttle Data Center recorded data.

Command and Control Processor

- Provide the capability to save, individually by name, images to local disk of the:
  - On-Line Databank
  - Current Value Table (no real-time update)
  - Application Set Load

- Provide the capability to load an image, individually by name, from local disk of the:
    - On-Line Databank
    - Current Value Table
    - Application Set Load
- Provide the capability to output, on demand to the Real-Time Critical Network values of all local derived FDs.
- Provide the capability to update the On-Line Data Bank from the Data Distribution Processor.

Command and Control Workstation

- Provide the capability to save, individually by name images, to local disk of the:
    - On-Line Databank
    - Current Value Table (no real-time update)
    - Display Set Loads
    - Plot Setup
    - Constraint Viewer Setup
    - FD Viewer Setup
    - Message Viewer Setup
- Provide the capability to update On-Line Data Bank from the Data Distribution Processor.

Requirements from SLS

- After a “warm boot”, the RTPS shall be restored to normal function. [Partial]
- After a “warm boot”, the RTPS shall be capable of restoring to a checkpointed function. [Partial]
- The RTPS shall provide a method to store current configuration data, [Complete]
- The RTPS shall provide a method, in real-time, to make updates to stored configurations. [Complete]
- The RTPS shall provide a method to restore previously stored configuration data. [Complete]
- The RTPS shall provide the capability to scan all HIM outputs and confirm that they are the same as current commanded state. [Complete]
- The RTPS shall provide the capability to make real-time configuration updates/modifications portions of SCIDs and TCIDs without requiring a complete reload of the SCID or TCID. [Partial]

Other System Requirements

- 4.9.4 The system shall provide a method for logging persistent FD information. [Partial]
- 4.9.5 The system shall provide a method for initializing, updating, and reading persistent storage structures. [Partial]

8.2.7

Business And Support Information Services (BASIS) Phase 1

Overview:

This thread takes the effort of the BASIS pathfinder and other activities and continues to build BASIS capabilities, and provides an early deployment of the Support Workstation in the LCC.

Highlights:

- Develop new Shuttle Data Stream
- Support selected CCWS functions in BASIS
- Early deployment of Support Workstation
- Resolve long term plan for Dynamic Display Tool

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

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    - Low = function only implemented in one subsystem,
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    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Review CSCI and CSC allocation
- Resolve Dynamic display tool long term plan selecting from following list considering foundation development, application development, performance, cost, operational cost, hardware required.
- Continue BASIS pathfinder efforts
- Develop new Shuttle Data Stream for KSC and other Centers
    - Provide data function for Support Workstation and Office Workstation
- Support selected CCWS functions in BASIS
    - Provide Application Service to support Command and Control Workstation functions on Support Workstation and Office Workstations.
    - Port prototype viewer effort to BASIS environment.
- Provide limited early deployment of Support Workstation to LCC, (three in each Control Room). Include capability to support:
    - PCGOAL DOS Mode (dual boot)
    - PCGOAL Windows Mode
    - BASIS Phase 1 Functionality. Examples are:
        1. Robust CAP WEB Interface
        2. Initial Advanced Data Analysis Tool Ph1
        3. CLCS Retrieved Data Presentation Ph1
        4. PCDAP
        5. Near Real-time Advisory tools
        6. SCAN

- Resolve Dynamic Display Tool long term plan, considering:
    - foundation development
    - application development
    - performance
    - cost
    - licensing issues
    - operational cost
    - hardware required
    - the following candidates:
        1. 1.G2
        2. Java Applets
        3. Java applications
        4. JView from SL Port
        5. JView Heavy Client Mode
        6. JView Heavy Server Mode
        7. Lab Views
        8. PCGOAL Client Server
        9. PCGOAL DOS Mode
        10. PCGOAL DOS Window.
        11. PCGOAL Window Rewrite
        12. SL-GMS Heavy Client
        13. SL-GMS running on BASIC
        14. SL-GMS Win server
        15. SL-GMS X server
- Demonstrate prototype viewer effort to BASIS environment.

Requirement from SLS

requirement are not being included at the current time but should be include as part of DP1 along with the review of the BIN section of the SLS and the Conops.

8.3

APPLICATION SOFTWARE THREAD GROUP

- Desktop Debug Environment Thread
- Near Real-time Advisory Thread
- Advanced Data Support Thread

8.3.1

Desktop Debug Environment Phase 2 Thread

Overview:

This thread establishes the application software Desktop Debug Environment (DDE) by building on the Thor delivery. Application software debug is performed jointly by the Desktop Debug Environment and the IDE. Application software validation is performed in the IDE. The Desktop Debug Environment provides a standalone light weight capability for individual application software developers to develop and debug all types of RTPS user application software products (including regression test scripts) from the office environment. The Desktop Debug Environment is the application software primary debug tool and is capable of debugging the bulk of applications software. The tool is light weight and has limitations necessary to make the cost of developing the tool affordable and executable in the existing desktop office computers. The IDE provides full debug of all application software functions but is a limited resource.

Highlights:

- Objective: Provide basic Thor application support in Desktop Debug Environment.
- Support user application software debug required to debug the vast majority of user application software in a stand-alone single user mode.

Ground Rules:

- Provide a light weight compatible user application execution support at the Applications Service API level that is in sync or leading RTPS deliveries.
- As a design goal, utilize Application Services (Basic & Tailored) without requiring Desktop Debug Environment unique modifications.
- Runtime compatibility with the RTPS is limited to basic functional compatibility necessary for application debug and does not extend to performance and timing compatibility.
- Relegate highest cost and/or least used debug support features to IDE/SDE to manage cost and allow support of existing office target platforms. Candidates for exclusion from Desktop Debug Environment, in the early phases, include:
    - LDB and onboard services (OCF) other than FD read/write. Thor: BITE, GMEM, Master/Reset, TEXT, DEUE, etc.
    - Viewers or other System Applications not specifically listed.
    - Many operations will be null (default is null): Gateway A/I, Health status, Data Fusion A/I, etc.

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Provide capability to add/modify/delete FDs locally at the Desktop Debug Environment as a debug aid (no interface/affect on DBSAFE FD definitions). Provide a report of modifications made locally to FDs to aid in manually submitting changes to DBSAFE.

- Provide data fusion execution support and the capability to develop Data Fusion scripts.
- Provide PCL execution support and the capability to develop PCL scripts.
- Provide modification and update in the CM Repository of Data Fusion and PCL scripts.
- Constraint Management.
- HPUX support
- Potential support for subsequent phases:
    - Command and Control Workstation Monitor Process/Command and Control Processor Monitor Process
    - Test Application Script
    - Regression Test Scripts including math model control
    - HCI Monitor Process/Command and Control Processor Monitor Process initiation/termination
    - System Viewers: FD, Data Fusion, System Message, Constraint Management
    - Support Application Service local logging & retrieval
    - Provide regression test support for both Desktop Debug Environment and user applications

Requirement from SLS

- SDEs shall support Minimal Configurations to allow application development/debug on a single workstation. [Partial]
- The CLCS must provide a development environment in which System and User Applications Developers can develop and debug their software without all of the equipment that will be required to run the program when it is placed in the operational environment. The capability must include simulation; however, this simulation capability does not need to run in real-time. [Partial]
- The CLCS shall provide an Application Test-bed Environment in which Systems and User Applications can be developed and debugged from office areas with minimal equipment. [Partial]

8.3.2

Near Real-time Advisory Thread

Overview:

This thread supports advisory system capabilities for the CLCS Support Workstation and the Office Environment. The plan is for the UNIX based advisory systems to run in the Shuttle Data Center on the Advanced Application Server. The user would then invoke an X-Terminal to the Application from the Support Workstation or from the Office. There are some concerns regarding this implementation's effect on the performance of the individual advisory systems. There are also some concerns regarding the execution of multiple instances of these advisory systems effect on the CLCS and KSC networks. The efforts for Atlas will provide resolution to these issues. However, PSA will not be ported to the Advanced Application Server. It has been determined that the short term solution for PSA is to be accessed via an xterminal session from BASIS to the existing PSA. In the future PSA functionality will be absorbed by CLCS. SDC and ADAT will absorb the graphics plotting requirements and the RTC and SL will absorb the display requirements.

There is one Near Real-time Advisory System being implemented for Atlas that is platform independent. This is the JVIEW System. JVIEW is a JAVA based version of PCGOAL. Atlas should provide a good set of JVIEW capability to the CLCS community.

Highlights:

- Integrate OPUS into CLCS
- Integrate High Speed Display into CLCS
- Integrate PSA into CLCS
- Continuation of JView development for CLCS

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
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    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Integrate OPUS into CLCS
    - Provide initial deployment of OPUS system to CLCS.
    - Using CLCS data deploy Telemetry Data Services.
- Integrate High Speed Display into CLCS
    - Provide initial deployment of High Speed Display to CLCS.
    - Provide Pulse Display Capability.
- Integrate PSA into CLCS
    - Provide initial deployment of PSA system to CLCS
    - Develop capability to access from BASIS
- Continuation of JView development for CLCS
    - Additional Graphing/Plotting functionality
    - Support Client Multi-cast capability

- Provide a method of creating and editing new displays
- Investigate integration of SL displays with JView
- Support for CLCS Real-time Data (as opposed to CCMS Real-time Data)
- Support for CLCS Historical Data (as opposed to CCMS Historical Data)

Requirement from SLS

Requirements are not being included at the current time. Some form of trace to SDC, SLS and ConOps should be provided for DP1.

8.3.3

Data Support Tools Thread

Overview:

This thread supports historical data retrieval and analysis similar to but improved upon what would be found on the CDS HI-TRAX system today. A Robust CAP Program Web Interface as well as the second phase of the Advanced Data Analysis Tool, (ADAT), will be featured in Atlas. The Phase II CLCS Retrieved Data Presentation (RDP) will be delivered.

Highlights:

- Continuation of Robust Cap Program Web Interface development
- Continuation of the Advanced Data Analysis Tool, (ADAT) development
- Continuation of the CLCS Retrieved Data Presentation development

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

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- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
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    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Continuation of Robust CAP Program Web Interface
    - Provide Additional CAP GUI for CAP 113
    - Provide servlet to enable closing of holes in firewall
    - Provide Enhancements to Existing GUIs
- Advanced Data Analysis Tool, (ADAT) Phase II
    - Provide capability to save users data to a workstation
    - Provide support for other table view formats
    - Provide access to online data status (DSTAT)
- Phase II CLCS Retrieved Data Presentation (RDP)
    - Develop additional retrievals
        - Develop a retrieval that combines the Console Activity Trace retrieval and the Operator Communications Retrieval
        - Develop a retrieval to support LDB/UPLK command data reporting
    - Enhancements to existing retrievals
        - Output in health column
        - FD’s requested as a group
        - FD’s selectable by type and source
        - Output to a data file

Requirement from SLS

Requirements are not being included at the current time. Some form of trace to SDC, SLS and ConOps should be provided for DP1.

8.4

APPLICATION SUPPORT THREAD GROUP

- End Item Manager Phase 2 Thread
- Constraint Manager Completion Thread

8.4.1

End Item Manager Phase 2 Thread

Overview:

This thread establishes the CLCS capability to provide process control application programs, and replace the GOAL functionality for the CCP subsystem. The purpose of this thread is to get the End Item Manager (EIM) to full working status in the RTPS system, and to lay the groundwork for future integration of Test Application Scripts (TAS).

The End-Item Management function provides the capability for users to create End-Item Manager applications to perform closed loop control of a specific End-Item system or component. A hierarchy of End-Item Managers will exist for large and complex End-Item Systems.

This thread demonstrates the system software capability to allow all classes of Applications Software (User Displays, End Item Managers, and Test Application Scripts) to communicate between one another, both within the same processor and across processors

Highlights:

- Integrate End Item Managers with RTPS
- Begin integration of Test Application Scripts with RTPS

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

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    - Low = function only implemented in one subsystem,
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Editor New Satement of Work EIM John Copella

- Specify, develop, and exercise external interfaces required to enable development of EIM application software during the Titan time frame. EIM external interfaces involve the following CSCIs/CSCs (note: some of these interfaces will be directly exercised; others will be employed indirectly through one or more service layers):

Application Software

- CCP Manager Program (CMP) Application
- End Item Manager (EIM) Applications (normal priority)
- EIM Reactive Control Logic (RCL) Applications (high priority)
- Prerequisite Control Logic (PCL) Applications
- Test Application Script (TAS) Applications
- User Display Applications

System Services Software

- Application Services
    - FD Services

- Subsystem Services
- Onboard Services
- Interapplication Communication Services
- EIM Services
- PCL Services
- User Display Services

- System Services
  - Network Services
  - Timer Services
  - System Message Services

System Applications

- Gateways
  - Common Gateway Services
  - GSE Gateway Services
  - PCM D/L Gateway Services
  - LDB Gateway Services
- System Control
  - OPS CM
  - System Integrity
- Data Distribution and Processing
  - Data Distribution
  - Data Health
  - Data Fusion
- Constraint Management
- Command Support
- Data Recording, Archival, and Retrieval
- Test Build and Control
- Desktop Debug Environment

General

Control Shell

- Procure, install, and integrate ControlShell v6.0 into the CLCS development network. A beta release will be delivered in late January with the production software to follow 4-6 weeks later.
- Acquire vendor training for the v6.0 product, and begin development of KSC tailored training materials.
- Update EIM Services software to compatibility with the ControlShell v6.0 production release.
- Update EIM Services software to compatibility with Thor Application Services. Maintain compatibility with Atlas Application Services as they are developed (to greatest extent practical).
- Provide and populate configuration-controlled ControlShell repository with EIM Services components.
- Provide EIM Services user documentation, training materials, and example code.

- Provide and populate configuration-controlled ControlShell repository for reusable EIM application components (“molecules”).

General

- Implement Application Services identified for development during Atlas (ref. Application Software API requirements matrix).
- Develop EIM application component documentation, training materials, and example code.
- Develop configuration management and Test Build integration plans for EIM applications component repository.
- Develop interfaces required to enable high-priority processing of constraint violations associated with Reactive Control Logic (RCL)
- Develop application software necessary to verify/validate delivered external interfaces.
- Develop application software necessary to acquire EIM-related performance benchmarks.

Perform end-to-end demonstration illustrating:

- EIM application requirements capture
- Mapping of application requirements to EIM implementation
- EIM development/debug in office environment
- EIM configure to TCID
- EIM load into operational set
- EIM functional demonstration exercising run-time external interfaces
- TAS demonstration exercising TAS/EIM interfaces

Requirements from SLS

- RTPS shall provide the capability to delegate and define closed loop control of one or more End-Items to an End-Item Manager. [Complete]
- The RTPS End-Item Manager function shall provide the capability to automatically safe the End-Item and continue if commanded when a RTPS system fault occurs. [Partial]
- RTPS shall provide the capability to delegate continuous End-Item monitoring to Constraint Management and respond to Constraint Management notification events. [Complete]
- RTPS shall provide the capability to operate an End-Item using rate based control. [Complete]
- RTPS shall provide the capability for an End-Item Manager Test Application to issue a command to another End-Item Manager Test Application. [Complete]
- RTPS shall provide the capability to alter the state of frame rate/time domain control based on an event. [Complete]
- RTPS shall provide priority Reactive Sequence control processing for End-Item Managers requiring minimum reaction time to Constraint Management notification events. [Complete]

Other System Requirements

- 4.6.1 The system shall provide a method to identify system errors caused by API calls. [Complete]
- 4.6.2 The system shall provide a method to translate API error codes into system text messages which may be displayed for the user. [Complete]

- 4.6.3 The system shall provide a method to specify application error routines which are called on the occurrence of user specified error conditions. [Complete]
- 4.7.1.1 The system shall provide a method to specify timer events which can occur at user defined intervals with a granularity of 10 milliseconds. [Complete]
- 4.7.1.2 The system shall provide a method to specify multiple timers within a single application. [Complete]
- 4.9.6 The system shall provide a method for opening, closing, updating, reading, and writing disk files in a user definable format. [Complete]

8.4.2

Constraint Manager Completion Thread

Overview:

This thread builds on the initial Constraint Management Tool. Constraint Management provides the capability to monitor Measurement FDs for a predetermined condition and notify personnel operating the Test Set and software applications executing within the Test Set that the monitored data no longer meets the predetermined condition.

Highlights:

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
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    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational
- Define the list of logical, mathematical, and relational functions required by the users for Constraint Management
- Provide the final Pre-Build Constraint Management Editor.
- The CLCS shall provide the capability to monitor measurement data (both converted count data or calibrated engineering units) for out of limits excursions and notify registered users when any of the following conditions occurs by obtaining and converting the current sample rate obtained from the gateway for hardware FDs to a period.
    - N samples in a row meet the constraint
    - N samples in a given time meet the constraint
- There is less than a specified time between constraint events
- Provide the capability to access current constraints and their algorithms.
- Provide performance tuning.
- Provide a common enumeration return for values returned by all types constraints and constraint functions.
- Allow constraints to be defined for continuous or one-shot monitoring.
- Allow constraints to be created by loading a pre-defined Constraint File that is contained on the DDP. Constraint Files can be loaded for one-shot or continuous monitoring and can define the content of a compound or summary constraint.
- Investigate support for Atomic, Compound, and Summary Constraints.
    - Atomic Constraints test/constrain a single FD (including enumeration FDs such as summary constraint FDs) to be in specified state.

- Compound Constraints are a combination of atomic, compound and summary constraints joined by x-Of-y, AND, or OR. Both the compound constraint and the voted constraints retain their individual status. On the Constraint Viewer, the status of voted constraints are displayed under their associated voted constraint. At the compound constraint level, both the status of the compound constraint and an indication of violating voting must be provided so that test article redundancy can be monitored. The members of a compound constraint are fixed when the constraint is defined. Through the Constraint Viewer, member constraints can be forced to be ignored, passed or failed and the voting count for x-Of-y can be altered.
- Summary Constraints employ a unique Summary Constraint FD for each summary constraint to which constraints (atomic, compound, or summary) may be associated and released over time. Summary constraints always have a state and initially are not associated with any constraints. The state of summary constraint is the AND or all associated constraints. When a constraint is asserted, it can be associated with summary constraint. A Parent Summary constraint can be assigned to a Summary Constraint at Test Build time. For example a summary constraint could be "EPD Launch Commit Criteria", and its parent summary constraint could be "Launch Commit Criteria". Any user or application can obtain the status of a summary constraint FD by reading its FD. Any application can use it as a constraint by just asserting an atomic constraint on the summary constraint FD.

- Investigate visibility and control of atomic, compound and summary constraints from the Constraint viewer. For compound and summary constraints, provide the capability to monitor the status of a group and also its components.

Requirements from SLS

- The RTPS shall provide the capability to monitor Measurement FDs at the rate the data changes and determine when predefined constraint limits are exceeded or constraint conditions are met. [Complete]
- The RTPS shall provide the capability for multiple (TBD number) users and system or user applications to request notification of constraint events for each Measurement FD. [Complete]
- The RTPS shall allow an application to set more than one set of limits on any Measurement FD. [Complete]
- The RTPS shall provide the capability for each user, and system or user application requesting constraint notification to specify the limits/conditions under which they will be notified. [Complete]
- The RTPS shall provide the capability to monitor measurement data (both converted count data or calibrated engineering units) for out of limits excursions and notify registered users when any of the following conditions occur:
  - N samples in a row that meet the constraint [Complete]
  - N samples in a given time that meet the constraint [Complete]
  - There is less than a specified time between constraint events [Review]
- CLCS shall provide the capability for any user and system or user application to create new constraints from an application, keyboard, or predefined file, determine and/or view the current constraints and their algorithms, or modify the list of constraints and select the algorithms relating to them. [Complete]
- The RTPS Constraint Management function shall be fault tolerant. [Partial]
- The RTPS shall provide the capability to test for or view constraint violations at a summary level (e.g., Launch Commit Criteria or OMRS) [Partial]

Other System Requirements

- 4.5.2.5 The system shall provide a method to specify and cancel event notification and an event handler for user selection of display objects. [Complete]
- 4.2.4.1.2 The system shall provide a method for changing the constraint state of a discrete FD. [Complete]
- 4.2.4.1.3 The system shall provide a method for changing the constraint condition for a digital pattern FD. [Complete]
- 4.2.4.1.4 The system shall provide a method to activate or inhibit constraint checking associated with an FD for an application. [Complete]
- 4.2.4.1.7 The system shall provide a method for reading the FD constraint indicator (event) for an FD. [Complete]
- 4.2.4.1.8 The system shall provide a method for reading the return to limits indicator (event) of an FD. [Complete]
- 4.2.4.1.9 The system shall provide a method for reading an FD's low limit violation indicator (event) for all analog constraint limit sets. [Complete]
- 4.2.4.1.10 The system shall provide a method for reading an FD's high limit constraint indicator (event) for all analog constraint limit sets. [Complete]
- 4.5.2.1 The system shall provide a method to specify and cancel event notification and an event handler for the expiration of a system timer with a granularity of 10 milliseconds. [Complete]
- 4.5.2.4 The system shall provide a method to specify and cancel event notification and an event handler for the occurrence of an FD constraint violation. [Complete]
- 4.2.4.1.5 The system shall provide a method for reading the constraint limits associated with an analog FD for an application. [Complete]
- The system shall provide a method for reading the constraint conditions associated with a discrete FD for an application. [Complete]
- 4.3.2.5 The system shall provide a method to read the constraint limit processing status in the data fusion function. [Complete]
- 4.5.2.7 The system shall provide a method to activate or inhibit all event notifications active for application. [Complete]
- 4.5.2.6 The system shall provide a method to periodically check for an event notification without the use of an event handler. [Complete]
- 4.5.2.8 The system shall provide a method to activate or inhibit all FD constraint notifications active for the application. [Complete]
- 4.2.4.1.11 The system shall provide a method for determining which system asserted a constraint when an FD is marked with a constraint limit violation. [Complete]
- The system shall provide a method for changing the constraint condition for an enumerated FD. [Complete]
- 4.3.1.5 The system shall provide a method to activate or inhibit data fusion limit checking for any class of limits. [Complete]

8.5

SYSTEM SUPPORT THREAD GROUP

- Log, Record and Retrieval Phase 2 Thread
- System Build, Platform Build and Load Phase 2 Thread
- Test Build, Load, and Activation Phase 2 Thread

8.5.1

Log, Record and Retrieval Phase 2 Thread

Overview:

This thread continues the development of CLCS Recording and Retrieval capability and the interfaces between RTPS and SDC for data recording and data retrieval.

Highlights:

- Provide for recording and retrieval of additional CLCS data types.
- Provide data recording and retrieval interfaces between RTPS and Shuttle Data Center.

Statement Of Work

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- If the requirement will have to be verified for HMF to be declared operational

Complete all Thor Requirements summarized below:

- Provide initial capability to record and retrieve CLCS FD's with health, time, and reason code information.
- Provide the capability to record and retrieve all CLCS Commands.
- Provide the capability to record and retrieve all CLCS System Messages.
- Provide the capability to record and retrieve all CLCS packets.

Note: Filtering appropriate to the data type will be provided on retrieval. Examples are: Source, Destination, Type, Time, etc.

Add capability to record and retrieve additional CLCS Data Types, as follows:

- Provide the capability to record and retrieve all CLCS Block Log Data
- Provide the capability to record and retrieve all inter-process communication between User Applications.
- Provide the capability to record and retrieve all inter-subsystem messages.
- Provide the capability to record and retrieve all CLCS Command Response.
- Provide the capability to record and retrieve all CLCS Fused Data FD and Fused FD parameter changes.
- Provide the capability to record and retrieve all CLCS Pseudo FD changes.
- Provide the capability to record and retrieve all CLCS Constraint Management violation events..
- Provide the capability to record and retrieve all CLCS Messages sent to and received from the Constraint Manager..

- Provide the capability to record and retrieve selected CLCS System and User Application data.
- Provide the capability to record and retrieve Shuttle Mass Memory dump data.
- Provide the capability to record and retrieve all CLCS configuration data.
- Provide the capability to record and retrieve all CLCS communications to the Maintenance Monitor function.
- Provide the capability to record and retrieve all CLCS System Integrity communications.
- Provide the capability to record and retrieve selected CLCS resource utilization data.
- Provide the capability to record and retrieve all CLCS real-time diagnostic messages.
- Provide the capability to record and retrieve all CLCS performance monitor messages and alerts.

Note: Filtering appropriate to the data type will be provided on retrieval. Examples are: Source, Destination, Type, Time, etc.

- Provide Hardware and Software interface between RTPS and Shuttle Data Center for recording of Multicast RTPS data.
  - Provide the capability to assign one or two interfaces to each RTPS test set to provide redundancy for data recording, as required.
  - Provide RTPS standard reliable messaging and system integrity functions.
  - Provide the capability to pass the complete packet, including RM header, in the data stream for recording.
  - Provide a merged, time-stamped recording data output stream containing all Multicast packets, in the order received.
  - Provide a selectable packet filtering capability, based on CLCS packet type, log bit, or flow control/handshaking.
  - Provide a system health function to periodically poll the SDC for data stream Recording status.
  - Provide the capability to report the status of SDC data stream recording as a part of subsystem health .
  - Provide the capability to accommodate bursts in data volume.
  - Provide the capability to transmit, with minimum delay, the recording output stream to the SDC, with error recovery.
  - Provide the capability to temporarily store the data stream on disk, and in the event the communication path or the recording process in SDC is interrupted, forward the stored data stream to SDC-DRD when the communication path or recording process is restored.
- Provide the interface for RTPS Command and Control Workstations (CCWS) and Command and Control Processor (CCP) to request and receive Retrieved Data from Shuttle Data Center.
  - Provide the capability to assure the security and integrity of the DCN connection.
  - Provide the capability to connect two interfaces to the DCN to provide redundancy for retrievals.
  - Provide the capability to insure connections originate only on the RTPS side of the interface.

- Provide the capability to pass only point-to-point traffic on this interface between RTPS and SDC.
- Provide the capability to block all Multicast traffic to the SDC on this interface.

Requirements from SLS

- The RTPS shall record user actions that result, or potentially result, in changes to the state of the system (e.g., initiation of a program, issuing commands, program prompts and their responses, control panel switch changes, program text information messages, etc.). [Complete]
- RTPS inter-process communication between User Applications shall be recorded to the Shuttle Data Center. [Complete]
- The RTPS shall record all inter-subsystem messages to the Shuttle Data Center [Complete]
- The RTPS shall time tag all data with 100 microsecond tags for recording purposes. [Complete]

Measurement and Command Processing

- The RTPS shall record all measurement changes along with the health and sample time to the Shuttle Data Center. [Complete]
- The RTPS shall record all commands and command responses to the Shuttle Data Center. [Complete]
- The RTPS shall record all Fused Data FD and Fused FD parameter changes to the Shuttle Data Center. [Complete]
- The RTPS shall record all Pseudo FD changes to the Shuttle Data Center. [Complete]
- The RTPS shall record all measurement health changes to the Shuttle Data Center. [Complete]
- The RTPS shall record all Constraint Management violation events to the Shuttle Data Center. [Complete]
- All messages sent to and received from the Constraint Manager shall be recorded to the Shuttle Data Center. [Complete]

Miscellaneous System Services

- The CLCS shall provide the capability for System and User Applications to record data to the Shuttle Data Center. [Complete]
- The RTPS shall record all System Messages to the Shuttle Data Center. [Complete]
- The RTPS shall provide the capability to record memory dump data to the Shuttle Data Center. [Partial]

System Control

- The RTPS shall record all configuration information to the Shuttle Data Center. [Partial]
- The RTPS shall record all communications to the Maintenance Monitor function to the Shuttle Data Center. [Partial]
- The RTPS shall record all System Integrity communications to the Shuttle Data Center. [Partial]
- The RTPS shall record resource utilization data for off-line analyses. [Partial]
- The RTPS shall record all real-time diagnostics messages to the Shuttle Data Center. [Partial]
- The RTPS shall record all performance monitor messages and alerts to the Shuttle Data Center. [Partial]

Retrieval Requirements

- The RTPS shall provide the capability for System and User Applications to retrieve near-real-time and archived data from the Shuttle Data Center. [Complete]

Other System Requirements

- 4.9.1 The system shall provide a method for logging function designators values and health indicators to a permanent archive. [Complete]
- 4.9.2 The system shall provide a method for logging text data to a permanent archive. [Complete]
- 4.9.3 The system shall provide a method for logging user defined data formats to a permanent archive. [Partial]
- 4.9.4The system shall provide a method for logging persistent FD information. [Partial]
- 4.9.5 The system shall provide a method for initializing, updating, and reading persistent storage structures. [Partial]

8.5.2

System Build, Platform Build and Load Phase 2 Thread

Overview:

This thread supports the definition, build, and loading of target CLCS Sets that is independent of Test Build. A single System Build can support multiple Test Build and Test Build revisions. The definition and build portions are independent of the hardware destination CLCS set. A CLCS Set Class defines the scaleable architecture makeup of the set but does not limit the quantity of subsystems in a Target CLCS Set. That is it defines whether Command and Control Processor's and Data Distribution Processor's are combined, etc. See section 11.3 for allocation of control function to threads.

Highlights:

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

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    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

Editor Note Need Statement of Work System Build JW

Requirements from SLS

- The SDC shall provide the capability to build, and release, single and System Loads containing the Subsystem Loads for each supported RTPS Configuration in both operations and development environments. [Partial]
- The SDC shall provide the capability to build Subsystem Loads for each supported RTPS Configuration. [Partial]
- The SDC shall provide the capability to build and maintain Platform Loads consisting of COTS Operating Systems and COTS tools which are required to support a Subsystem Load. [Partial]
- The SDC shall provide a means of defining which Platform Loads are required for a System Build [Partial]
- The time required to load the Platform Load and SCID onto a single RTPS subsystem's local storage device shall take less than 30 minutes. [Reference]
- The time required to load a launch configuration Test Set shall not exceed 2 hours. [Reference]

8.5.3

Test Build and Load Phase 2 Thread

Overview:

This thread Supports Test definition, build, load and activation of a Target CLCS Set that has been loaded with a System Build load. A single Test Build can support multiple of Synchronized System Builds. See section 11.3 for allocation of control function to threads.

Highlights:

Statement Of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:

- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

General Support

- Define & support parametric definition of the build content. Parameters include: action, TCID, descriptor, build threads, and test environments.
- Build actions include: add TCID/TCID flow segment, delete TCID /TCID flow segment , modify TCID/TCID flow segment , and build TCID flow segment.
    - Support make (incremental build), and make clean (full rebuild.)
- Maintain test load support for the following test environments if selected in the build content definition: office development workstations, DDE (each supported platform), SDE, IDE, and production sets.
- Establish and document the build thread organization including separate build threads for a SCID stage, each Application Set, any Application Set content build up, data fusion, PCL and CORBA IDL.
    - Create Test SCT Templates for each Application Set destined for a CCP.

Resource Management

- Establish a Resource Data Base that maintains application set definitions, user class definitions, system and test resource definitions.
    - Maintain the mapping between User Classes and resources including those defined in the Resource Data Base and FD resources maintained in DBSAFE.
    - Support all Test Builds, i.e. be site independent.
    - Support multiple concurrent flows.
    - Allow any User Class to be allocated to any resource.
    - Provide the capability to perform controlled updates to the Resource Data Base.
    - Provide necessary reports.

FD Management

- Provide build thread support for maintaining FD include, FD implementation files (C++) and object files by Application Set.
    - Do not overlay (cause the time stamp to change) previous version of FD include files if necessary content has not changed to prevent unnecessary makes.
    - *Maintain FDIDs cached within the TCID common segment.*
    - *Include the superset of FDs in each flow segment build necessary to support flows.*
    - *Mark all FD's not present in a TCID flow in the OLDB as absent from the TCID.*

Configuration Authentication

- Ensure that the application build process for each type of application verifies that all dependencies of that application are met prior to installation.
- Ensure that the interface between an application and any dependency is defined properly and is fully compatible to the interface of the dependency.
    - *Capture and automatically maintain the dependencies of each application in an Inverted Index Data Base. (Titan)*
    - *Provide assessment predictive reports that show the expected impacts of changing a resource. (Titan)*
    - *Provide alert reports that show the current unresolved impacts to changing a resource. (Titan)*

Table Build

-

Application Build: General

- Application Build: CORBA IDL
    - Implement Configuration Authentication support for all Test Build CORBA IDL.
    - Provide a build thread to support CORBA IDL.
- Application Build: PCL
    - Implement Configuration Authentication support for all PCL.
    - Provide a build thread to support PCL.
- Application Build: Test Displays
    - Implement Configuration Authentication support for all Test Displays.
    - Provide a build thread to support Test Displays.
- Application Build: EIMs
    - Implement Configuration Authentication support for all EIMs.
    - Provide a build thread to support EIMs.
- Application Build: Constraint Files
    - Implement Configuration Authentication support for all *Constraint Files.*
    - Provide a build thread to support *Constraint Files.*
- *Application Build: G2 Advisory Applications(Titan)*
    - *Implement Configuration Authentication support for all G2 Advisory Applications. (Titan)*
    - *Provide a build thread to support G2 Advisory Applications. (Titan)*
- *Application Build: TCS-S(Titan)*

- *Implement Configuration Authentication support for all TCS-S. (Titan)*
- *Modify & integrate the existing TCS-S Configuratior into the Test Build process. (Titan)*
- *Provide a build thread to support TCS-S. (Titan)*

Preference Data Management

- Define what types of preference data are required.
- Establish a preference data library by User Class and promotion stage.
- Viewers provide preferences save capability to local computer preference directory by User Class.
- *Support capture of locally generated/changed preference data into the preference data library. Data is updated for the requestors User Class for all promotion stages at or below the the current promotion stage of the Test Set. (Titan)*
- *Include in a Test Build Flow Segment load any preference data required by included User Classes at that promotion stage. (Titan)*
- *Include relevant preference data into the Test Build load. (Titan)*

Persistent Data Management

- *Support flow and site persistence. Flow persistent data is captured into the current flow segment Site persistent data is captured into the common segment. (Titan)*
- *Support definition of level of persistence required for any pseudo FD within DBSAFE. (Titan)*
- *Capture changed data logged from an RTPS set that is persistent into the TCID. (Titan)*
- *Include relevant persistent data into the Test Build load. (Titan)*

Requirements from SLS

- The SDC shall provide a central repository of Function Designator information. [Complete]
- The SDC shall provide a means of managing the Function Designator data housed in the repository. [Complete]
- The SDC shall provide report generating tools for access to the Databank, Online Databank and related TCID information without user knowledge of database structure or SQL. [Complete]
- The SDC shall provide a means of managing executable Application Software housed in the CLCS Configuration Management Environment. [Partial]
- The SDC shall provide a means of defining the criteria for the selection of data to be included in the test load. [Partial]
- The SDC shall provide a temporary repository to contain the data selected for inclusion in the test load. [Partial]
- The SDC shall provide a means of building the non-executable data loads required by the RTPS, such as Gateway tables, Online Data Bank, etc. [Partial]
- The SDC shall provide a means of building the executable data loads required by the RTPS, such as CCP End Item Managers, HCI User Displays, etc. [Partial]
- The SDC shall provide a means of defining which System Builds are usable for a Test Build Load [Partial]
- The elapsed time to complete a Launch Configuration Test Build shall
    - Not include the time to create the Data Base for the test configuration [Reference]

- Not exceed 30 minutes to populate the Test Configuration Directory with required information extracted from the Data Bank [Reference]
- Not exceed 45 minutes to generate the Online databank file, Gateway Processor files, and System Configuration file [Reference]
- Not exceed 45 minutes to collect the application SW and dynamic display files required for the test, and to transfer the appropriate files to Operation Servers [Reference]

- The time required to load a launch configuration Test Set shall not exceed 2 hours. [Partial]

Other System Requirements

- **4.1.3** The system shall support strong compile time checking and external symbol resolution. The system shall minimize the need for run-time dependency checking. [Partial]

9.

ATLAS OPERATIONAL DELIVERIES.

- Shuttle Data Center - Record Retrieval - CDS Re-platform
- Simulation System Re-host - CDS Re-platform

9.1

SHUTTLE DATA CENTER - RECORD RETRIEVAL - CDS RE-PLATFORM

Overview:

This delivery is to provide continued use of the Shuttle Data Center as a replacement for CDS.

Highlights:

- Continued operational support for selective systems.

Statement Of Work

- Provide support for Fuel Cells
- Release first production release of Shuttle Data Center Software
- Activate Shuttle Data Center for validation
- Prepare to go Operational (Titan 10/18/98)

9.2

SIMULATION SYSTEM RE-HOST - CDS RE-PLATFORM

Overview:

This delivery is to provide initial uses of the re-host simulation system.

Highlights:

- Initial operational support for selective system.
- Deployment of Simulation System on the second floor of the LCC
- Initial software release of Simulation System Software

Statement Of Work

- Provide support of HMF SGOS Model for Desk Top Debug.
- Provide support of HMF SGOS Model by way of VSI.
- Provide initial support for SGOS model validation.

10.

CSCI NON THREAD RELATED WORK

11. ATLAS

- System Software Thread to CSCI Impacts
- Application Software to CSCI Impacts
- System Control Function to Thread Allocation

Editor Note Need to fill in and all allocation tables updateded DP1

11.1

ATLAS DELIVERY SYSTEM SOFTWARE THREAD CSCI IMPACTS

Key: X = Impact or Dependency

CSCI	CSC	Function	Expert Systems	System Capability Demo	System s Test	PCM Gateway	LDB Gateway	Safing	Timing	CD Gateway	Commanding	Data
System Services												
	Network Services											
	Access Control/Security											
	Logging Services											
		Local Logging Services										
		SDC Logging Services										
	Interprocess Communications											
	System Message Services											
	Timer Services											
	Initialization & Termination Services											
	Display Services											
	Utility Services (print, etc.)											
	Operating System (COTS)											
Application Services												
	FD Services											
	Subsystem Services											
	Onboard Services											
	Interapplication Communication Serv											
	Constraint Management Services											
	User Display Services											
	Data Path Services											
	Data Fusion Services											
	End Item Manager Services											
	Prerequisite Control Services											
	Test Application Script Services											
	User Advisory Services											
	Math Model Services											
	System Application Services											
Data Distribution & Processing												
	Data Distribution											
	Data Health											
	Data Fusion											
	Constraint Management											
System Viewers												
	Constraint Viewer											
	FD Viewer											
	FD Monitor											
	System Message Viewer											
	Test Applications Script Viewer											

System Software Thread CSCI Impacts

CSCI	CSC	Function	Expert Systems	SystemCapability Demo	Systems Test	PCM Gateway	LDB Gateway	Safing	Timing	CD Gateway	Commanding	Data
		Performance/Capacity Monitor										
Command Support												
		Command Processor										
		Command Management										
		Timer Display										
Orbiter Computation Facility (OCF)												
System Control												
		System Integrity										
			Redundancy Management										
			Subsystem Integrity										
		Ops Configuration Manager										
			Activity Management										
			RTPS System SW Load and Init										
			Test Load										
			System & Test Load Verification										
System Diagnostics												
		On-line Readiness Test										
		Subsystem Diagnostics										
Common Gateway Services												
		Gateway Initialization										
		Gateway Command & Response										
		Gateway RTCN Services										
		Gateway Timer Services										
		Gateway Utility Services										
		Gateway Maintenance User Interface										
		Gateway Subsystem Integrity										
Consolidated System Gateway Services												
GSE Gateway Services												
		GSE Gateway Table Load										
		GSE Gateway Initialization										
		GSE Gateway HIM Hardware Test										
		GSE Gateway Command Processor										
		GSE Gateway Measurement Processing										
		GSE Gateway Issue Command										
		GSE Gateway Table Maintenance										
		GSE Gateway Fuel Cell Simulation(CITE)										
		GSE Gateway Subsystem Integrity										
LDB Gateway Services												
PCM D/L Gateway Services												

System Software Thread CSCI Impacts

CSCI	CSC	Function	Expert Systems	SystemCapability Demo	Systems Test	PCM Gateway	LDB Gateway	Safing	Timing	CD Gateway	Commanding	Data
Uplink Gateway Services												
Sim Gateway Services												
CLCS Development Environment												
	Configuration Management Environment											
	System Software Development Tools											
		Regression Test Tools										
	User Appl SW Development Tools											
		FD Design Tool										
		TCS-S Compiler										
System Build												
	Platform Build											
	Subsystem Build											
DBSAFE												
Test Build & Control												
	Table Build											
	On-Line Data Bank Build											
	FD Directory Build											
	OCF Build											
	Build Utilities											
		Load Checker										
		Cross Reference (IIU)										
		TCS-S Configurator										
Data Recording/Archival & Retrieval												
	Data Recording/Archival & Retrieval Services											
	Data Retrieval Applications											
SDS Services												
	SDS Client Services											
	SDS Server Services											
Near Real-time Advisory												
	Orbiter Power Up Monitor System (OPUS)											
	APU Neural Net Tool (ANNT)											
	High Speed Display											
	Propulsion Advisory Tool (PAT)											
	Java View (JView)											
Support Advisory												
	Robust CAP Program Web Interface (RCW)											
	Advanced Data Analysis Tool (ADAT)											
	Interfaces to COTS Packages											
	Retrieval Data Presentation (RDP)											

System Software Thread CSCI Impacts

CSCI	CSC	Function	C&CW S 1	System Control	System Redun -dancy	Check - point	Check -point	Desk - Top Debug	Real time Advi- sory	Ad- vance Re- trieval	Basis	End Item Man
System Services												
	Network Services											
	Access Control/Security											
	Logging Services											
		Local Logging Services										
		SDC Logging Services										
	Interprocess Communications											
	System Message Services											
	Timer Services											
	Initialization & Termination Services											
	Display Services											
	Utility Services (print, etc.)											
	Operating System (COTS)											
Application Services												
	FD Services											
	Subsystem Services											
	Onboard Services											
	Interapplication Communication Serv											
	Constraint Management Services											
	User Display Services											
	Data Path Services											
	Data Fusion Services											
	End Item Manager Services											
	Prerequisite Control Services											
	Test Application Script Services											
	User Advisory Services											
	Math Model Services											
	System Application Services											
Data Distribution & Processing												
	Data Distribution											
	Data Health											
	Data Fusion											
	Constraint Management											
System Viewers												
	Constraint Viewer											
	FD Viewer											
	FD Monitor											
	System Message Viewer											
	Test Applications Script Viewer											

System Software Thread CSCI Impacts

CSCI	CSC	Function	C&CW S 1	System Control	System Redun -dancy	Check - point	Check -point	Desk - Top Debug	Real time Advi- sory	Ad- vance Re- trieval	Basis	End Item Man
Performance/Capacity Monitor												
Command Support												
Command Processor												
Command Management												
Timer Display												
Orbiter Computation Facility (OCF)												
System Control												
System Integrity												
Redundancy Management												
Subsystem Integrity												
Ops Configuration Manager												
Activity Management												
RTPS System SW Load and Init												
Test Load												
System & Test Load Verification												
System Diagnostics												
On-line Readiness Test												
Subsystem Diagnostics												
Common Gateway Services												
Gateway Initialization												
Gateway Command & Response												
Gateway RTCN Services												
Gateway Timer Services												
Gateway Utility Services												
Gateway Maintenance User Interface												
Gateway Subsystem Integrity												
Consolidated System Gateway Services												
GSE Gateway Services												
GSE Gateway Table Load												
GSE Gateway Initialization												
GSE Gateway HIM Hardware Test												
GSE Gateway Command Processor												
GSE Gateway Measurement Processing												
GSE Gateway Issue Command												
GSE Gateway Table Maintenance												
GSE Gateway Fuel Cell Simulation(CITE)												
GSE Gateway Subsystem Integrity												
LDB Gateway Services												
PCM D/L Gateway Services												

System Software Thread CSCI Impacts

CSCI	CSC	Function	C&CW S 1	System Control	System Redun -dancy	Check - point	Check -point	Desk - Top Debug	Real time Advi- sory	Ad- vance Re- trieval	Basis	End Item Man
Uplink Gateway Services												
Sim Gateway Services												
CLCS Development Environment												
	Configuration Management Environment											
	System Software Development Tools											
		Regression Test Tools										
	User Appl SW Development Tools											
		FD Design Tool										
		TCS-S Compiler										
System Build												
	Platform Build											
	Subsystem Build											
DBSAFE												
Test Build & Control												
	Table Build											
	On-Line Data Bank Build											
	FD Directory Build											
	OCF Build											
	Build Utilities											
		Load Checker										
		Cross Reference (IIU)										
		TCS-S Configurator										
Data Recording/Archival & Retrieval												
	Data Recording/Archival & Retrieval Services											
	Data Retrieval Applications											
SDS Services												
	SDS Client Services											
	SDS Server Services											
Near Real-time Advisory												
	Orbiter Power Up Monitor System (OPUS)											
	APU Neural Net Tool (ANNT)											
	High Speed Display											
	Propulsion Advisory Tool (PAT)											
	Java View (JView)											
Support Advisory												
	Robust CAP Program Web Interface (RCW)											
	Advanced Data Analysis Tool (ADAT)											
	Interfaces to COTS Packages											
	Retrieval Data Presentation (RDP)											

System Software Thread CSCI Impacts

CSCI	CSC	Function	Log, Record & Retrieval	Con - strain Man -age - ment	System Build	Test Build						
System Services												
	Network Services											
	Access Control/Security											
	Logging Services											
		Local Logging Services										
		SDC Logging Services										
	Interprocess Communications											
	System Message Services											
	Timer Services											
	Initialization & Termination Services											
	Display Services											
	Utility Services (print, etc.)											
	Operating System (COTS)											
Application Services												
	FD Services											
	Subsystem Services											
	Onboard Services											
	Interapplication Communication Serv											
	Constraint Management Services											
	User Display Services											
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	Prerequisite Control Services											
	Test Application Script Services											
	User Advisory Services											
	Math Model Services											
	System Application Services											
Data Distribution & Processing												
	Data Distribution											
	Data Health											
	Data Fusion											
	Constraint Management											
System Viewers												
	Constraint Viewer											
	FD Viewer											
	FD Monitor											
	System Message Viewer											
	Test Applications Script Viewer											

System Software Thread CSCI Impacts

CSCI	CSC	Function	Log, Record & Retrieval	Con - strain Man -age - ment	System Build	Test Build						
		Performance/Capacity Monitor										
Command Support												
		Command Processor										
		Command Management										
		Timer Display										
Orbiter Computation Facility (OCF)												
System Control												
		System Integrity										
			Redundancy Management										
			Subsystem Integrity										
		Ops Configuration Manager										
			Activity Management										
			RTPS System SW Load and Init										
			Test Load										
			System & Test Load Verification										
System Diagnostics												
		On-line Readiness Test										
		Subsystem Diagnostics										
Common Gateway Services												
		Gateway Initialization										
		Gateway Command & Response										
		Gateway RTCN Services										
		Gateway Timer Services										
		Gateway Utility Services										
		Gateway Maintenance User Interface										
		Gateway Subsystem Integrity										
Consolidated System Gateway Services												
GSE Gateway Services												
		GSE Gateway Table Load										
		GSE Gateway Initialization										
		GSE Gateway HIM Hardware Test										
		GSE Gateway Command Processor										
		GSE Gateway Measurement Processing										
		GSE Gateway Issue Command										
		GSE Gateway Table Maintenance										
		GSE Gateway Fuel Cell Simulation(CITE)										
		GSE Gateway Subsystem Integrity										
LDB Gateway Services												
PCM D/L Gateway Services												

System Software Thread CSCI Impacts

CSCI	CSC	Function	Log, Record & Retrieval	Con - strain Man -age - ment	System Build	Test Build						
Uplink Gateway Services												
Sim Gateway Services												
CLCS Development Environment												
	Configuration Management Environment											
	System Software Development Tools											
		Regression Test Tools										
	User Appl SW Development Tools											
		FD Design Tool										
		TCS-S Compiler										
System Build												
	Platform Build											
	Subsystem Build											
DBSAFE												
Test Build & Control												
	Table Build											
	On-Line Data Bank Build											
	FD Directory Build											
	OCF Build											
	Build Utilities											
		Load Checker										
		Cross Reference (IIU)										
		TCS-S Configurator										
Data Recording/Archival & Retrieval												
	Data Recording/Archival & Retrieval Services											
	Data Retrieval Applications											
SDS Services												
	SDS Client Services											
	SDS Server Services											
Near Real-time Advisory												
	Orbiter Power Up Monitor System (OPUS)											
	APU Neural Net Tool (ANNT)											
	High Speed Display											
	Propulsion Advisory Tool (PAT)											
	Java View (JView)											
Support Advisory												
	Robust CAP Program Web Interface (RCW)											
	Advanced Data Analysis Tool (ADAT)											
	Interfaces to COTS Packages											
	Retrieval Data Presentation (RDP)											

11.2

ATLAS DELIVERY APPLICATION SOFTWARE CSCI IMPACTS

CSCI	Function	HMF	Power Up / Down	Launch Ops	ORB SRB Hydraulics	Cryo MPS FIREX
CAS	Common Application Support					
SLL	SL-GMS Components					
HMP	HMP					
CMP	CMP					
CPP	Common C++ Code					
SLC	SL-GMS Driver Program Code					
SLT	Super Light Weight Tank					
HMF	Hypergolic Maintenance Facility					
PAY	CITE					
APU	Auxiliary Power Unit					
ARM	Swing Arms					
BAP	SRB Auxiliary Power Unit					
BHY	SRB Hydraulics					
BRS	Range Safety					
CME	Main Engine Avionics					
COM	Communication					
DPS	Data Processing system					
ECL	Env Control & Life Support					
ECS	Environmental Control System					
EFC	Electronic Flight Controls					
EPD	Electrical Power Distribution & Control					
FCP	Fuel Cell					
GID	Guidance					
GLS	Ground launch Sequencer					
HWS	Hazardous Warning System					
HYD	Orbiter Hydraulics					
ICE	Surface Ice					
INS	Instrumentation					
INT	Integrated OPS					
KUB	KU Band Radar					
LH2	Liquid Hydrogen					
LO2	Liquid Oxygen					
MEQ	Mechanisms					
MPS	Main Propulsion System					
MSTR	Master					
NAV	Navigation					
OMS	Orbiter Maneuvering / Reactive Control					
PLE	Payload Test					
SME	Space Shuttle Main Engines					
WAT	FIREX Sound Suppression					
CIN	CCS Integration					
CMS	CCS Master					
HVC	CCS Heating Vent and Air Control					
PNU	CCS Pneumatics					
PWR	CCS 60Hz Power					
WRT	CCS Water					

11.3

SYSTEM CONTROL FUNCTION TO THREAD ALLOCATION

	Other	System Control	Redundancy Management	Checkpoint	SCID Build	TCID Build
Environments						
· Master Console Control Navigation System		Future				
· System Engineering Control Navigation System	Apps					
Managers						
· Resource management						
· Manages the assignment of resources in a configurable set						
· Manages assignment of functions to hardware boxes		Atlas				
· Manages assignment of external interfaces in all sets.		Atlas				
· Operation Configuration Management						
· Coordinate the loading of subsystem SCID and TCID		Atlas				
· Coordinate subsystem activation state		Atlas				
· Coordinate software loads from Shuttle Data Center					Atlas	Atlas
· Coordinate Checkpoint loads		Atlas		Atlas		
· Test Progress Monitoring						
· Monitor the operational state of all subsystems and links		Atlas	Atlas			
· Monitor the state of platform system software loads		Atlas	Atlas			
· Monitor the state of platform application loads		Atlas	Atlas			
· Monitor the State of system software.		Atlas				
· Monitor the State of application software.		Atlas				
· Monitor the flow of Test Sequences and OMIs		Atlas				
· Maintenance Management						
· Collect, manage, and analyze health data						
· Collect and manage system errors.						
· Interface with maintenance database.						

System Control Function to Thread Allocation

	Other	System Control	Redundancy Management	Checkpoint	SCID Build	TCID Build
Agents -						
· SCID Load -						
· Subsystem OS Load -					Atlas	
· Subsystem System Software Load -					Atlas	
· Load verification -					Atlas	
· TCID Load -						
· Subsystem Application software load -						Atlas
· Subsystem Table Load -						Atlas
· Subsystem Activation -		Atlas		Atlas		Atlas
· Network Monitoring -						
· Network Statistics -		Future				
· Network Configuration and Management -		Future				
· Performance Monitoring -						
· Data rate collection -		Design				
· Data rate alarms -		Design				
· Error rate collection -		Design				
· Error rate alarms -		Design				
· Operational Readiness Test -						
· Coordinate Pre Load Diagnostics -		Atlas				
· Coordinate Pre Activation Subsystem Test -		Atlas				
· Coordinate Pre Activation Communication Test -		Future				
· Coordinate Pre Activation external link validation -		Future				
· Coordinate Standby mode testing -		Future				
· Coordinate operational fault detection diagnostics -		Future				
· System Integrity -						
· Coordinate and collect system health -			Atlas			
· Detect failover conditions -			Atlas			
· Coordinate Failover -			Atlas			

System Control Function to Thread Allocation

	Other	System Control	Redundancy Management	Checkpoint	SCID Build	TCID Build
Subsystem Process -						
· Application Manager -						
· HCI Monitor Process monitor and control Display tasks on a Command and Control Workstation -	Apps					
· Command and Control Processor Monitor Process monitor and control application tasks on a Command and Control Workstation -	Apps					
· Subsystem Checkpoint -						
· Saves table baselines -				Atlas		
· Restore table baselines -				Atlas		
· Update baselines in real-time -				Atlas		
· Subsystem Integrity -						
· Collect subsystem state -			Atlas			
· Collect subsystem health -			Atlas			
· Distribution of subsystem health -			Atlas			
· Distribution of subsystem state -			Atlas			
· Provide heart beat -			Atlas			
· Subsystem Redundancy -						
· Detect and report failures -			Atlas			
· Perform failover restarts -			Atlas			
· Maintain subsystem to subsystem Synchronizing -			Atlas			
· Subsystem Initialization -						
· Load subsystem -	SS				Atlas	Atlas
· Activate subsystem -	SS	Atlas	Atlas			
· Restart subsystem -	SS	Atlas	Atlas			
· Subsystem Operational Readiness Test -						
· Perform Pre Load Diagnostics -	ORT					
· Perform Pre Activation Subsystem Test -	ORT					
· Perform Pre Activation Communication Test -	ORT					
· Perform Pre Activation Link validation -	ORT					
· Perform Standby mode testing -	ORT					
· Perform operational fault detection diagnostics -	ORT					